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The Outlook

A.D.G.B. Redivivus

NO commander can enter upon an attack with a quiet mind unless he feels sure of the safety of his base. It would be a poor satisfaction to General Eisenhower to despatch his transports to the Continent, land his men, master the opposing defences with gunfire and bombing, and protect his ground troops and bombers with a victorious body of fighter aircraft, if his embarkation ports were to be laid waste behind him by the bombers of the enemy. Those ports have to be protected from the enemy bombers with the maximum of Allied energy. For this reason a new Home Defence Force of fighters, working with the A.A. guns, searchlights, and other elements of air defence, has come into being. It has been given the revived name of Air Defence of Great Britain. It will work under the general command of the Allied Expeditionary Air Force.

This new A.D.G.B. is different from the original force which bore that name in that the new body does not include a force of bombers as the old one did. It resembles rather the Fighter Command as that Command existed at the time of the Battle of Britain. One has, therefore, to scratch one's head to find a sufficient reason for the change of name.

One possible consideration which may have induced the Air Ministry to change all the familiar names, except that of Bomber Command, is as follows. In 1940 Fighter Command was purely a defensive body, which saved Britain from invasion. In the intervening years Fighter Command developed into an aggressive body, constantly attacking the parts of Europe within the range of its aircraft, and constantly lengthening that range. It has by now grown to a status which permits it to take part in the invasion of the Continent, and has become in fact and in name the Second Tactical Air Force. Working side by side with the American 9th Air Force, it will perform all the functions which an Army requires from the air. Together these two bodies will reconnoitre, bomb the enemy's positions, and provide fighter cover for bombers and ground troops alike.

The German Problem

THE Germans, perhaps, have not high expectations of being able to master these Allied Air Forces over the scene of the landing. For a long time past they have been short of bombers, and in any case bombers working by day need fighter protection. Their fighter factories have recently been very hard hit, and they also need their fighters for use against the Allied heavy bombers. Night attacks, and perhaps also some day raids, on the embarkation ports in Britain might well seem to them their most hopeful line of countermeasures. To guard against that the new A.D.G.B. has come into existence.

It is, however, organised as part of the Allied Expeditionary Air Force, and rightly so. Its function will be quite different from that of Fighter Command in 1940. The word "Defence" in its title is only of tactical significance. It will not have to protect Britain from invasion as Fighter Command had to do in the Battle of Britain. Its part will be to help the invasion of the Continent by guarding the bases from air attack. That the Germans have made preparations for an air attack on the invasion is evidenced by the renewal of raids on London and south-east England. They have increased the number of their bombers in the West, but numbers alone will not achieve much. Skill is also required, and the recent night raids have shown no evidence of skill in hitting military targets.

Civil Aviation

THE Air Estimates debate on civil aviation produced a good deal of heat but little comfort for those who had hoped that the House was reasonably clear on the broad lines which it wishes commercial flying to take after the war.

Messrs. Bowles and Hughes had quite obviously taken considerable trouble to study the past sad history of British civil aviation, but they then proceeded to draw from their studies conclusions which were not in all cases very logical. Mr. Bowles proposed a world air authority which should own and operate all transport aircraft.

The Labour Members did their level best, with fair success it must be admitted, to "debunk" the extravagant claims made by enthusiasts for the huge volume of air traffic that will be offering after the war. Mr. Quintin Hogg retorted that the right way to look at it was not how large a percentage the air would take but to take into account the fact that the air was creating a new type of traffic.

That appears to be the sane view, but obviously, apart from Empire air routes, little can be done except in complete accord with our great Allies the United States and Russia.

Berlin—Day and Night

AT last, after a period (and, all things considered, a surprisingly short period) of building up strength, the U.S. Army 8th Air Force has raided Berlin by day. Ever since the arrival of the first parties in the British Isles, the commanders of that force have pursued the wise policy of learning to walk before they tried to run. Only very rash and foolish men would have done otherwise. They had to amass strength so that losses could be replaced; they had to learn all the tricks of the day-bombing trade in a climate which was foreign to them; they had to produce a body of escort fighters when they found that escorts were essential; and they had to feel their way gradually forward, step by step.

When the great day came for the first raid on the enemy capital, the Americans did not lose their heads in the excitement of the moment, but took every precaution to avoid a fiasco. On the day before they sent fighters by themselves over Berlin. On the day itself they struck in various directions, only allowing one formation to fly to the capital, and thus dispersed the fighter defence. They chose a day of thick cloud and high winds, and so minimised their losses. Yet they made a gesture, by sending some formations of fighters to sweep to 20 miles beyond Berlin, just to show what they could do. And this wisely cautious beginning was promptly followed up on a larger scale.

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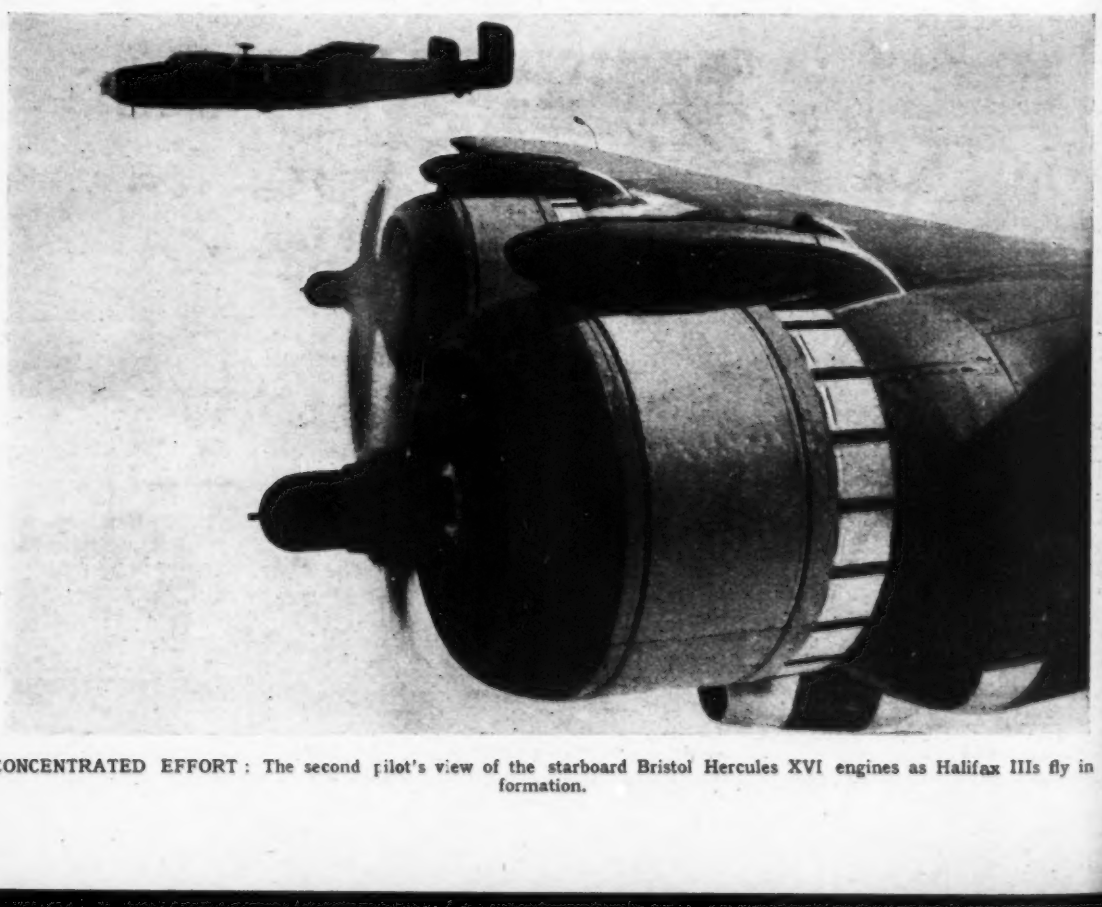
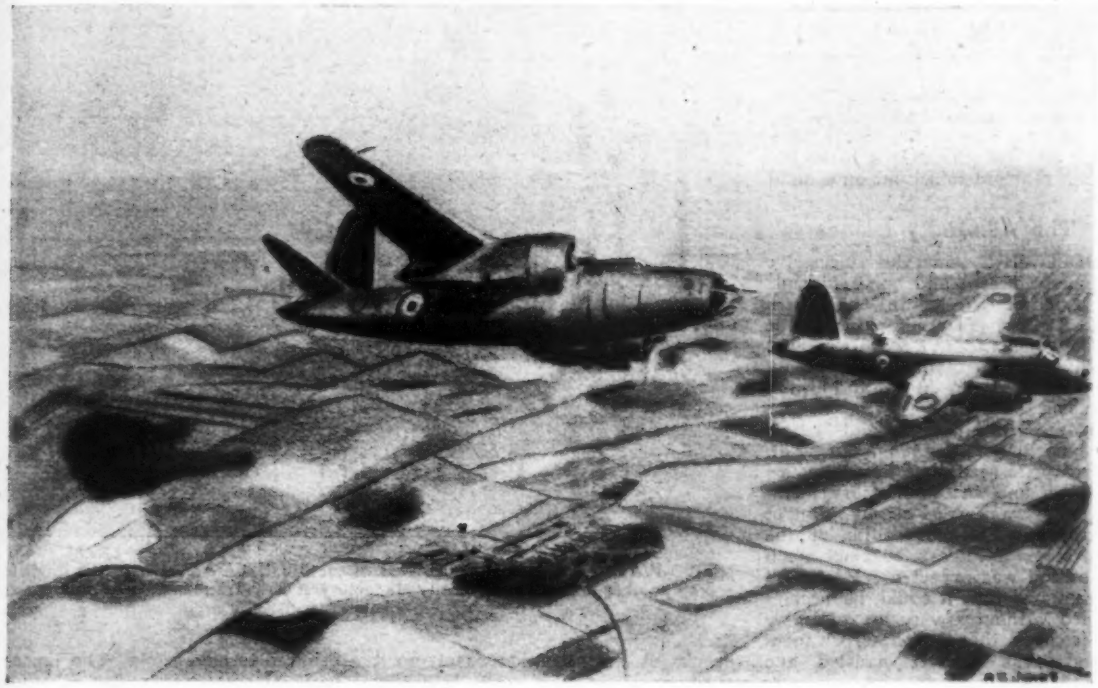


CONCENTRATED EFFORT: The second pilot's view of the starboard Bristol Hercules XVI engines as Halifax IIIs fly in formation.



R.A.F. Marauders picking up formation. From a pencil sketch by R. G. Jones.

WAR in the AIR

Supplies by Air in Arakan Victory : Seizure of Admiralty Islands : Heavy Bombers' Part in Anzio Battle

THE South East Asia Command, or perhaps we should say the Fourteenth Army, has at last fought a considerable battle with the Japanese in Burma, and has gained a striking victory. Apparently the initiative came from our side, as a steady advance in Arakan challenged the Japanese to offer resolute opposition. They tried to be too clever, and to cut off the 7th Indian division from its communications. The division immediately organised itself into groups of strong defensive positions, hit back as opportunity offered, and waited for relief.

Measured by past standards, the Japanese plan did not seem a bad one. No doubt they reckoned that the various groups of the 7th Indian division would soon run short of food and munitions, and would be wiped out before relief could come. This seemed a reasonable supposition, except that the enemy forgot one thing, namely the air. It was strange that they should have overlooked this factor, for the adventures of Brigadier Wingate's force a year ago had shown how troops in Burma could be supplied by air. The contingent of Transport Command in India and Burma again came to the rescue, and the detachments of the 7th Indian division were kept supplied. In the meantime other British and Indian troops cut off the too-enterprising advanced Japanese force in its turn, and practically exterminated it. It was a victory important enough to bring a message of congratulation from the Prime Minister to Lord Louis Mountbatten. None the less, but for Transport Command, the incident might have been a severe set-back for the British and Indian forces.

Talking of the Burma campaign, one cannot help feeling a little amused at the remarks of Capt. Harold Balfour in the debate on the Air Estimates when he answered a question about dive-bombers. He said that while it was true that we had received those which we had ordered from the United States, practice had shown that fighter-bombers had proved to be more successful for the particular function which a dive-bomber performed than the dive-bomber itself. No doubt he was quite right, but the Vengeance dive bombers to which the question related have been sent to Burma, and seem to be doing quite useful work against the Japanese. That is not to say that they would be suitable for the more modern forms of warfare now in vogue in Europe; but having bought the Vengeances we had to use them somewhere, and in Burma they seem to be justifying their existence. It should not be thought that the argument is that anything is good enough for the Burma campaign; but when one side enjoys such conclusive air superiority as the Allies now hold there, one can make use of classes and types of aircraft which it would not be wise to use in other theatres.

Major-General Lethbridge, who has led a combined British, American and Canadian mission to the S.E. Asia Command, has stated that the Allied margin of air superiority there was not so great as he would like to see it. The reports of operations, however, show that our superiority is quite substantial.

Another unusual proceeding has been reported from the Burma front. Not long ago American heavy bombers raided Moulmein and Martaban by night. So Americans can bomb by night, when occasion arises, though in the West and the Mediterranean they

WAR IN THE AIR

are convinced believers in day bombing, and are trained and equipped for it. On this side of the world they would not feel themselves to be experts if required to set out on a night raid.

The Admiralty Islands

FOLLOWING on the successive naval sweeps and bombardments by Admiral Nimitz in the North Pacific, Gen. MacArthur has made a very significant move in the south-west area of that ocean, by landing troops in the Admiralty Islands, to the north-west of the Bismarck Archipelago, and nearly due north of Madang, in New Guinea. He used dismounted cavalry troopers, and the preliminary bombardment was carried out by a line of destroyers. The composition of the force seems to indicate that not much opposition was expected. It was all to the good that it could be accomplished without a very great display of air cover, though it has been mentioned that aircraft assisted the gunfire of the destroyers. It was certainly convenient that there was no necessity to bring carriers and the powerful escort which they need down for this operation. Probably it would have taken carriers a long time to have arrived on the scene, and in any case Admiral Nimitz must need all the carriers he can muster for his raids on islands nearer to Japan.

It certainly looks as if the occupation of the Admiralty Islands will finally seal the fate of Rabaul and the other Japanese bases to the east. The official report issued in Australia speaks of the operation as of great strategic importance, and "marking the final stage in the great swinging move, pivoting on New Guinea, which has been the basic purpose of operations initiated on June 29th, 1943, when the South-West and South Pacific areas were united under General MacArthur's command."

British submarines, which naturally cannot report immediately after the actions in which they have taken part, have made a useful contribution towards the discomfiture of Japan. One has torpedoed a Japanese carrier of about 7,000 tons, and the victim is believed to have sunk. The Japanese have always professed a liking for small carriers, and no doubt they have advantages when the sea is calm, but in rough weather the difficulties of landing on are much accentuated.

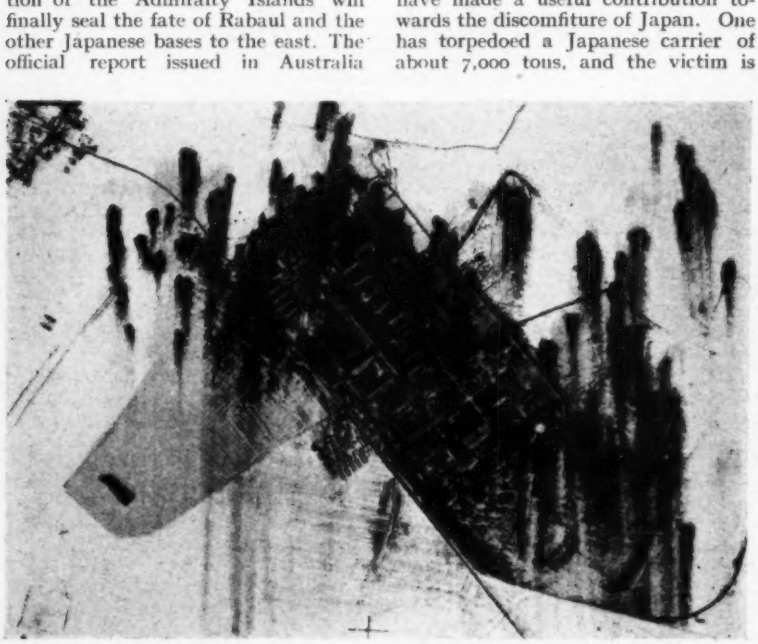
TWO-WAY ATTACK (2): Fortresses of the 8th U.S.A.A.F. flying from England drop another load of bombs on the Me factory at Ober Traubling. (See photograph below.)

Bombs and Shells

AT the Anzio beachhead the Germans made their third major attempt to drive the Allies into the sea, and they failed. For a time they gained ground, and must have inflicted somewhat severe casualties, especially on the Americans. The latter counter-attacked with excellent results. Again the heavy bombers, Fortresses and Liberators, played a tactical part in the battle, and by night the Wellingtons were out bombing important communications a few miles behind the enemy lines. On the whole the weather was against much air activity, and it is reported by correspondents that the artillery played the chief part in breaking up many German attacks and generally in restoring the situation.

It is a feature of a well-prepared modern battle that a General should be able to use fire from the ground or from the air or both, according to the circumstances of the moment. It will be remembered that in many of the fights in the East African campaign artillery could not be brought to bear in the mountains, and then all the heavy hammering had to be done by the aircraft.

In a recent series of day operations over northern France it was remarked that fighters of the U.S. 9th Air Force employed tactics which may be part of their invasion plans. While the American heavies were battering the airfield at Chartres, a group of Mustangs kept



TWO-WAY ATTACK (1): The Messerschmitt factory at Ober Traubling as it appeared to the 8th U.S.A.A.F. as they arrived over the target three days after the 15th U.S.A.A.F. had blasted it from Italy.

WAR IN THE AIR

ENEMY AIR LOSSES TO MAR. 4th

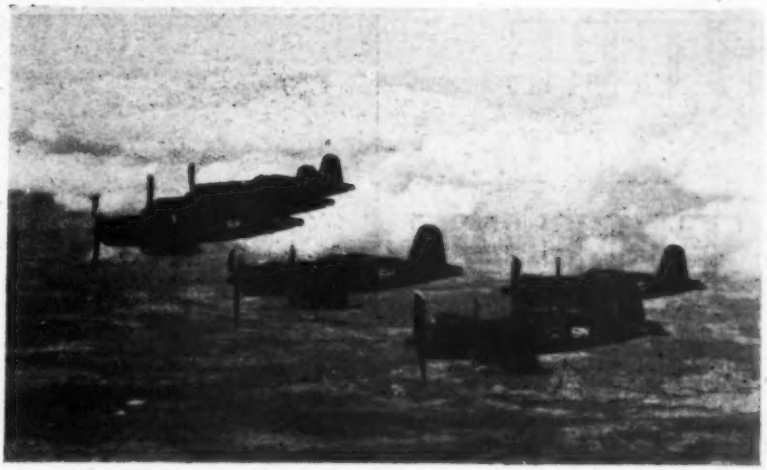
	Over G.B.	Continent	Middle East	Italy
Feb. 27 ...	0	0	0	1
" 28 ...	0	0	0	0
" 29 ...	2	2	1	6
Mar. 1 ...	5	2	0	1
" 2 ...	0	0	0	0
" 3 ...	0	0	0	15
" 4 ...	0	0	0	1
	7	4	1	24

Totals : West, 8,039 ; Middle East, over 5,833 ; N.W. Africa and Italy, 4,654.

sentry-go over four enemy airfields west of Paris for an hour and a half, ready to attack any German fighter which might try to take off. No such attempt was made.

These tactics are not novel. They were used in the last war, and the most notable occasion was on the eve of Allenby's great advance in Palestine. It was most important that the Turks should believe that the main attack would be made on the east, whereas it was on the sea shore that the cavalry actually broke through. So on the eve of the attack Camels kept up continuous sentry-go over the Turkish airfields, and not an enemy aircraft was able to fly over the British lines to report the true state of affairs.

After a fairly easy initial success, the Americans have run into some fairly stiff fighting in the Admiralty Islands. The key point there is the airfield at Momote, and the Japanese, having lost it without much of a defence, made some strenuous efforts to regain it. The outcome was a furious infantry battle, in which the Japanese attacked recklessly and lost heavily. The Americans are reported to have lost only 61 killed and 244 wounded, which is a very moderate loss for a hardly contested battle, while the enemy are believed to have lost some 3,000 killed and wounded.



AERIAL PIRATES : Corsairs of a Fleet Air Arm squadron practise formation flying. The squadron is forming up as a fighting unit in the United States.

Americans Reach Berlin

LAST Saturday American heavy bombers with an escort of fighters flew far into Eastern Germany, and one formation penetrated to the Berlin area and dropped its bombs there. The loss on the day's work was 14 bombers and 23 fighters, which seems moderate.

On the preceding day American fighters, Lightnings, had made what is described as an offensive sweep over Berlin. It was evidently a try-out for the morrow's work, for no particular results of the sweep were chronicled. On the Saturday, too, Mustangs of the 9th Air Force flew to a point 20 miles east of Berlin, making a record round trip of 1,200 miles. They flew through bitter cold and thick clouds (which, of course, shielded them from the attentions of German fighters), and for part of the way had to fight against a wind of 90 m.p.h. This would help them on their return journey. The two days' work was a remarkable demonstration of the powers of American fighters.

BRITISH & U.S. AIR LOSSES TO MAR. 4th

	Over G.B. A'cft.	Continent B'brs.	Continent F'trs.	Middle East A'cft.	Italy A'cft.
Feb.					
27	0	0	0	0	2
28	0	6	2	0	3
29	0	2	8	1	6
Mar.					
1	0	4	0	0	0
2	0	13	6	0	6
3	0	10	6	0	10
4	0	14	23	0	3
	0	49	45	1	30

Totals : West, 10,217 ; Middle East, about 2,377 ; N.W. Africa and Italy, 1,750.

Air Chief Marshal Sir Arthur Harris sent a message of hearty congratulations to General Doolittle on the achievement of his heavy bombers in having at last reached Berlin by daylight. He recalled that it was over a year since the German Capital was last bombed in daylight. That was an attack by Mosquitoes which interfered with a broadcast by Göring

Last week-end also saw the announcement that the scientists have now supplied the R.A.F. with a bomb weighing 12,000 lb. They were dropped by Lancasters by night in brilliant moonlight on aircraft factories in northern France. Strict orders were issued that bombs were to be brought back if there was any risk of missing the target, and one crew did bring its load home. Thus the minimum risk of hurting French people was run. The moonlight helped the bombardiers, though it also exposed the bombers to greater risk from the defences.

SHADES OF 1940: The recent resumption of night bombing of London has provided photographs of wrecked enemy aircraft which are reminiscent of the Battle of Britain days.

HERE AND THERE

R.Ae.S. Annual Meeting

THE annual general meeting of the Royal Aeronautical Society is to be held in the offices of the Society, 4, Hamilton Place, London, W.1, on Monday, March 27th, at 6 p.m.

Airgraphs to Turkey

AN agreement has been reached between the British and Turkish postal authorities for the extension of Airgraph services to Turkey from Great Britain and the Middle East. The service is now in operation.

"Air" on the Air

A TALK on "Post-war Air Transport," by Mr. Charles M. Newton, is to be broadcast by the B.B.C. on Tuesday next, March 14th. It will be in the Home Service programme at 4.50 p.m.—which is not a very convenient hour for those most likely to be interested.

"Lancs." from Australia?

J. CURTIN, Australian Premier, has stated that his Government has decided to manufacture heavy bombers. No type is mentioned, but it will be remembered that a Lancaster was recently sent to Australia, and that one went to Canada shortly before this type was put into production in the Dominion.

R.A.F. "Jungle" Kit

R.A.F. crews operating over Burma now take fishing tackle with them to give them a chance of catching their own food if they are forced down.

They are issued with complete jungle "life-saver" kits, which include waterproof matches, burning glass, compass, electric torch, chewing gum and dried fruit, hunting knife, and first-aid kit.

Up to Date

WHEN Mr. R. G. Casey, the new Governor of Bengal, recently made a four-day tour to learn at first hand the conditions in some of the areas worst affected by the famine, he did so by air, using his own aircraft which he took to India with him from the Middle East.

Airport Owners Confer

DETAILS of operational methods and future plans for American airports were heard in London recently by delegates to the annual general meeting of the Aerodrome Owners' Association. This information was given in a report by their chairman, Mr. C. M. Newton, of Sywell, Northampton, and Ald. O. C. Purnell, of Cardiff, prepared on their return from a tour of the U.S.

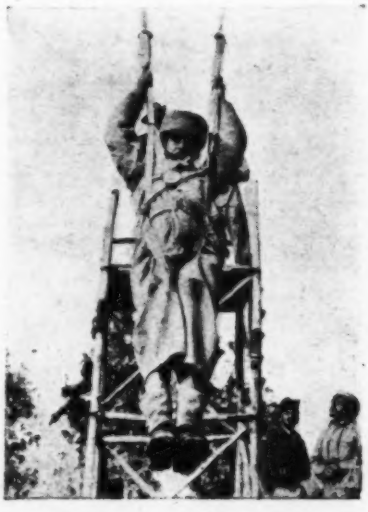
The future of British airports, both municipal and privately owned, was one of the chief subjects discussed at the meeting, and recommendations will be made by the Association to the British Government.

STEPPED UP: A formation of Grumman Avengers of the U.S. Navy sets out from its carrier-base to do a little energetic avenging. Probably the world's best among carrier-borne torpedo aircraft, it is also in service with the Fleet Air Arm.

Timely Warning

A WARNING about the "stiff international competition" that British aviation will have to face after the war from the U.S., Holland and Sweden was given a few days ago by Lord Knollys, the B.O.A.C. chairman, speaking in Sydney during his world tour.

Saying he would welcome competition, he recommended the retention of "the best features of private enterprise" together with a certain amount of Government ownership and supervision in the composition of British companies operating overseas. In that sphere cut-throat competition would be damaging.



TRIBESMEN IN TRAINING: R.A.F. Levies in Irak, composed of tribesmen renowned as fighters, are being trained as paratroops and for Commando units. This one is making a preliminary jump from a practice stand.

Changes in Parnall Board

MR. MAURICE HELY-HUTCHINSON and Col. L. V. S. Blacker have resigned from the board of Parnall Aircraft, Ltd., and the Earl of Limerick, Mr. R. Egerton Johnson and Mr. F. P. S. Stammers have been elected directors.

New Post

MR. H. G. MITCHELL, until recently production manager at the Austin aircraft "shadow" factory, has given up that appointment in order to join Mr. C. B. Wardman in the control and development of Kigass, Ltd., and Air Industrial Development, Ltd., Kigass House, 31, Regent Grove, Leamington.

Amalgamation

AN amalgamation of interests has taken place between Dualloys, Ltd., of Croydon, the plain bearing manufacturers, and Exactor Control Co., Ltd., 14, Berkeley Street, London, W.1.

Mr. J. W. Warrington, director and general manager of Exactor Control, has been appointed managing director of Dualloys, Ltd.

Australian Viewpoint

MR. ARTHUR DRAKEFORD, Commonwealth Minister for Air and Civil Aviation, speaking on the control of air transport in Australia, said in the House of Representatives that if the proposal to set up international air control failed, the Government would be willing to accept British Commonwealth of Nations control.

It did not appear to him, however, that international control of civil aviation would be more difficult to establish than the international postal union.

International ownership of airlines would prevent the ruinous scramble for

HERE AND THERE

business by competitive nations. Rivalry caused in the post-war years by competition and the refusal of landing rights could easily lead to a third world war.

From U.S. to U.S.S.R.

MORE than 7,800 aircraft, the great majority combat types, had been sent by America to Russia up to the end of 1943, according to a recent statement put out by the U.S. Office of War Information.

More than 3,000 of these were ferried all the way by air, and over 5,000 of the total sent were supplied during 1943, thus doubling the previous year's supply of aircraft to our Soviet Allies.

Last year, the types sent to equip the Red Air Force were mainly Airacobra (P-39A) fighters, Douglas A-20 attack-bombers, and North American Mitchells.

India's Big Air Plans

DAILY air services on main trunk air routes covering North, South, East and West India, with connecting services making it possible to leave any place in India and arrive at any other place the same day, are among India's post-war air plans.

Sir Gurunath Dewoor, Secretary for Posts and Air, outlining India's post-war aviation plans in the Central Assembly recently, said the annual flying mileage contemplated would be five times, and the ton mileage 15 times that of the air services operated before the war.

With the type of aircraft planned, the total transport affected would be 12,500,000 tons yearly. These aircraft would accommodate between 12 and 20 passengers.

The capital investment of the operating organisations would probably be between £2,250,000 and £3,000,000.

South Africa is Also Ready

MR. F. C. STURROCK, Union Minister of Transport, speaking in the House of Assembly, said that South Africa was preparing her post-war aviation plans, and, although it was difficult to envisage the final picture, the Government would be ready to act when the time came.

He agreed entirely, he said, that South Africa should play an important part in world aviation after the war.

He hoped the railways' "great good deed" in handing over all the aircraft to further the war effort would stand the railways in good stead when aircraft became available for civil work, and that South Africa would be put high on the priority list of Britain and America.

Ford's Post-war Plans

HENRY FORD, who for many years before the war, not very successfully ventured into the field of transport aircraft design and manufacture, and who more recently had considerable difficulty in getting Willow Run into full production, is planning to build large multi-engined passenger and cargo transports at Willow Run after the war, according to his statement made recently.

"We plan to take up the option given to us by the Government on Willow Run for post-war use," he said. In addition he stated the Ford Motor Co. may establish an aircraft factory in England.

Ford's greatest subsidiary, the Ford Motor Co., Dagenham, says *Interavia*, has built Rolls-Royce Merlin engines under licence for some time.

Bright Idea

WHEN Air Marshal Sir Leslie Gossage, recently appointed Chief Commandant of the A.T.C., paid a visit some days ago to No. 1020 Hackney Sqn., he saw the work and training of the Corps demonstrated in an unusual way.

A letter from an "old boy" now serving in the R.A.F., written to a present-day cadet, was presented in dramatised form. The cadets of his old A.T.C. squadron presented, in a series of scenes, a potted review of the various phases and activities of life in the A.T.C. recalled by the writer, from the first interview to the day he took leave of his comrades to join the R.A.F. with the white flash of an air crew candidate in his cap.

With Air Marshal Gossage at this demonstration was Air Chief Marshal Sir Wm. Mitchell, London A.T.C. Commandant.

Britain's Gliding Cadets

SOME 15,000 A.T.C. cadets have now attained various stages of proficiency in gliding and, during 150,000 glider launches, there has not been a single serious accident to a cadet during training.

These facts were given recently by Mr. W. W. Wakefield, formerly Director of the A.T.C., who said that after the war Britain should be "the air pylon of the world."

POTENTIAL PILOT: A young A.T.C. cadet, Flt. Sgt. G. Denham, of East Ham, who has just made a flight in a Kirby Kite sailplane, receives the smiling congratulations of Air Marshal Sir Leslie Gossage.

African Natives Buy Spitfires

FURTHER proof of the loyalty of the natives of Southern Rhodesia is given by the remarkable contributions to the special Spitfire Fund organised by the Native Affairs Department. The Spitfire was selected because this name is known to all natives throughout the country, even in the remotest areas.

The aim of the fund was to raise enough money to pay for two Spitfires by contributions of £5,000 each from the two provinces, Mashonaland and Matabeleland. This figure has already been exceeded by Mashonaland, where the fund totals £5,794, the major proportion coming from remote native reserves in rural areas. Matabeleland so far has contributed £4,143, which is expected soon to be brought up to £3,000.

Pleasant Change

THE lamentable fact that aircraft are at present being used almost entirely for destructive purposes makes it all the more pleasant to hear of an instance in which it has figured in an entirely peaceful achievement.

This was the recent discovery of the source of the Orinoco River by U.S. Army pilots. The 1,500-mile river, they found, springs from a mountain gorge in the jungle separating Venezuela and Brazil.

This discovery, by the way, is of considerable importance, because, owing to an agreement setting the boundary between the two countries as the watershed of the Amazon and the Orinoco, it means the boundary is now known to be farther east, and 1,000 square miles of country is affected.

D

"Flying's a new fad—can't last!"

R.A.A.F. ground staff service a "Spit. V." on the desert airfield.

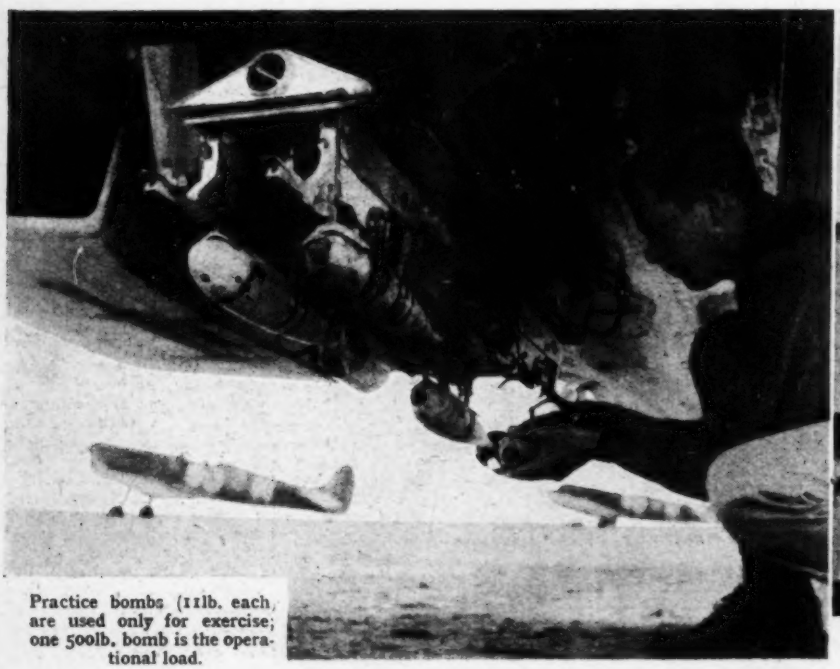
"Convoy Cover"

An R.A.A.F. Spitfire Squadron Stationed on a Lonely Airfield in the Western Desert, Helps to Protect Allied Shipping in the "N

EL ALAMEIN and the Western Desert have long since dropped out of the war news, yet there are still units —among them squadrons of the R.A.A.F.—serving in these almost forgotten places. Their job is to provide fighter protection for Allied convoys passing through the Mediterranean, and these pictures give a glimpse of one such R.A.A.F. Spitfire squadron based on one of the first desert airfields to be wrested from the enemy after the break-through at El Alamein. Conditions are exacting for both men and aircraft, with a temperature ranging in summer from well over 100 degrees F. in the shade to below freezing point at night, and flying (and working) conditions varying between violent tropical rain storms, and equally violent sandstorms.

Hours of duty for these pilots and their ground staffs are governed only by operational requirements, for they are constantly at the "ready" between dawn and dusk, and only the most impossible weather is allowed to restrict flying—the convoys MUST be got through.

The Spitfires are, of course "tropicalised," and their



Practice bombs (11lb. each) are used only for exercise; one 500lb. bomb is the operational load.

Yes, you've guessed! Making cigarette ligh[ters] matches are sca[rce]

(Left) The control officer has a few R/T words with a returning pilot. (Above) Pilots enjoy a little natter while the fitters make all ready. (Right) Veteran flight-rigger in action.

"Med." pilots say that the Vokes air-cleaner has very little effect on either speed or ceiling. A point of particular interest is that they are fitted with wooden-bladed airscrews which have been found to stand up remarkably well. "They have never yet given the slightest trouble," the squadron says in this exclusive "interview" for *Flight*.

Armament consists of four 0.303in. machine guns and two 20 mm. cannon, and they carry a 500lb. bomb under the centre-section. Runways often present a problem, and while sometimes the hard earth is itself suitable, it is generally necessary to lay special tracking, which most frequently takes the simple form of wire-netting.

Several marks of Spitfire are used.

spare time is prevalent even in the desert; petrol, anyway.

The "Ops." room is small but sturdily built against rain, sand and what-have-you. The sqn. ldr. on the phone is the unit's C.O. and holds the D.F.C.

R.A.F. Reorganisation

NOT everybody cares to read political speeches, even an abbreviated report of a speech by the Air Minister introducing the Air Estimates. The new organisation which Sir Archibald Sinclair described in his speech (a brief report of which appears on pages 265-6 of this issue) is discussed in our leading columns, but there no mention is made of the men who will lead the new formations. It is therefore useful to set forth the total facts clearly here.

At the beginning of the war the R.A.F. in the United Kingdom had three operational Commands, namely, Bomber, Coastal and Fighter. The first two of these remain, and do not concern this article any further. A new Command was formed in 1939-40, called the Royal Air Force in France. After the Dunkerque evacuation, this Command naturally ceased to exist, and in its place there was formed a new one, called Army Co-operation Command.

In the meantime the Army and Air Force in the Middle East set a new standard of combined ground-air work, which was carefully studied in the United Kingdom, and it is evident that the Air Council found that Army Co-operation Command did not come up to the new requirements. It was therefore abolished, after a brief existence, in which it had not been able to distinguish itself in any way, except by challenging the Navy's monopoly of the term "Silent Service." In its place was formed Tactical Air Force No. 2, on the lines of T.A.F. No. 1 in the Mediterranean. This new Force was not made an independent Command, but was placed under the general direction of Fighter Command, then boasting Air Chief Marshal Sir Trafford Leigh-Mallory as its A.O.C.-in-C.

Then came the collapse of Italy, and the Teheran Conference, at which agreement was reached with Marshal Stalin about the invasion of Europe from the West. In consequence, most of the successful commanders from the Mediterranean were recalled to Britain, and the forces were reorganised with a view to landing on the Continent.

From being A.O.C.-in-C., Fighter Command, Sir Trafford Leigh-Mallory became Chief of the Allied Expeditionary Air Force, under the supreme command of General Eisenhower. Fighter Command ceased to exist, at least in name, and the passing of the name called forth the regrets of Lord Trenchard.

Sir Trafford's new Command has been divided into three parts. These are Air Defence of Great Britain, the 2nd Tactical Air Force, under Air Marshal Coningham, and the U.S.A. 9th Air Force under General Brereton. The latter Force has been recalled from the Middle East. Some time ago the G.O.C. of the 8th U.S. 8th Air Force announced that he was forming a Tactical Air Force in his Command, on the lines of that which had proved so successful in the Mediterranean. Presumably this body has been merged now in the 9th Air Force.

Still, the old Fighter Command survives in function if not in name. It is represented by the new body known by the old name of Air Defence of Great Britain, and its A.O.C. is Air Marshal Sir Roderic Hill. It will be responsible for the day and night air defence of these islands. There can be no doubt that the A.A. guns and searchlights will stand in the same relation to it as they did to Fighter Command of yore.

This organisation is probably for "hostilities only," but it foreshadows the form which the Royal Air Force will have to assume after the war, when no American forces remain in the British Isles.

CONGRATULATIONS

IT is with a great deal of personal satisfaction that *Flight* extends, on behalf of its staff and readers, very hearty congratulations to Air Marshal Sir Roderic Hill on his appointment to the command of the new organisation under the revived title of Air Defence of Great Britain.

During the early days of flying, young Roderic Hill was a welcome and frequent contributor of drawings to our pages. He had that rare gift of being able to make an aircraft "fly" in his pictures, and we are very glad to know that he has, so far as his Service preoccupations have permitted, kept his hand in with many drawings and paintings, most of which are of very high artistic merit.

We have followed with great interest the careers of Roderic Hill and his brother Geoffrey (of Pterodactyl fame), and take a not unnatural "paternal" pride in their successes.

BOOK REVIEW

Target : Germany. (*Simon and Schuster, New York.*) $1.00.

THIS very fine account of the experiences of the U.S. Army Eighth Air Force's first year in Great Britain has been compiled for readers in America, but we are informed that H.M. Stationery Office is publishing an edition for the United Kingdom.

It is a story which will tell the American public much which it can hardly have learnt from any other source, and we feel sure that it will thrill, as well as instruct, its readers across the Atlantic. At the same time, it is calculated to open the eyes of British readers to many points about our gallant American visitors and Allies.

Inevitably, much of the space is occupied with narratives of bombing raids, on much the same lines as the publications of the Air Ministry News Service. To thoughtful British readers other features of this brochure will be of deeper interest. The author is exceedingly frank—in fact, frankness is one of the most pleasing characteristics of the work. Though he is naturally jubilant about the results of the year between August 17th, 1942, to August 17, 1943, he never hesitates to point out that mistakes were sometimes made, that results were sometimes disappointing, and that policy had gradually to be revised and developed. These confessions will perhaps be good for the souls of American readers; they will also increase the respect of British readers for the American effort.

Some British critics were inclined to depreciate that effort as having developed somewhat slowly. After reading this brochure they will understand some at least of the reasons for the pace of the development, and will appreciate the difficulties which had to be overcome.

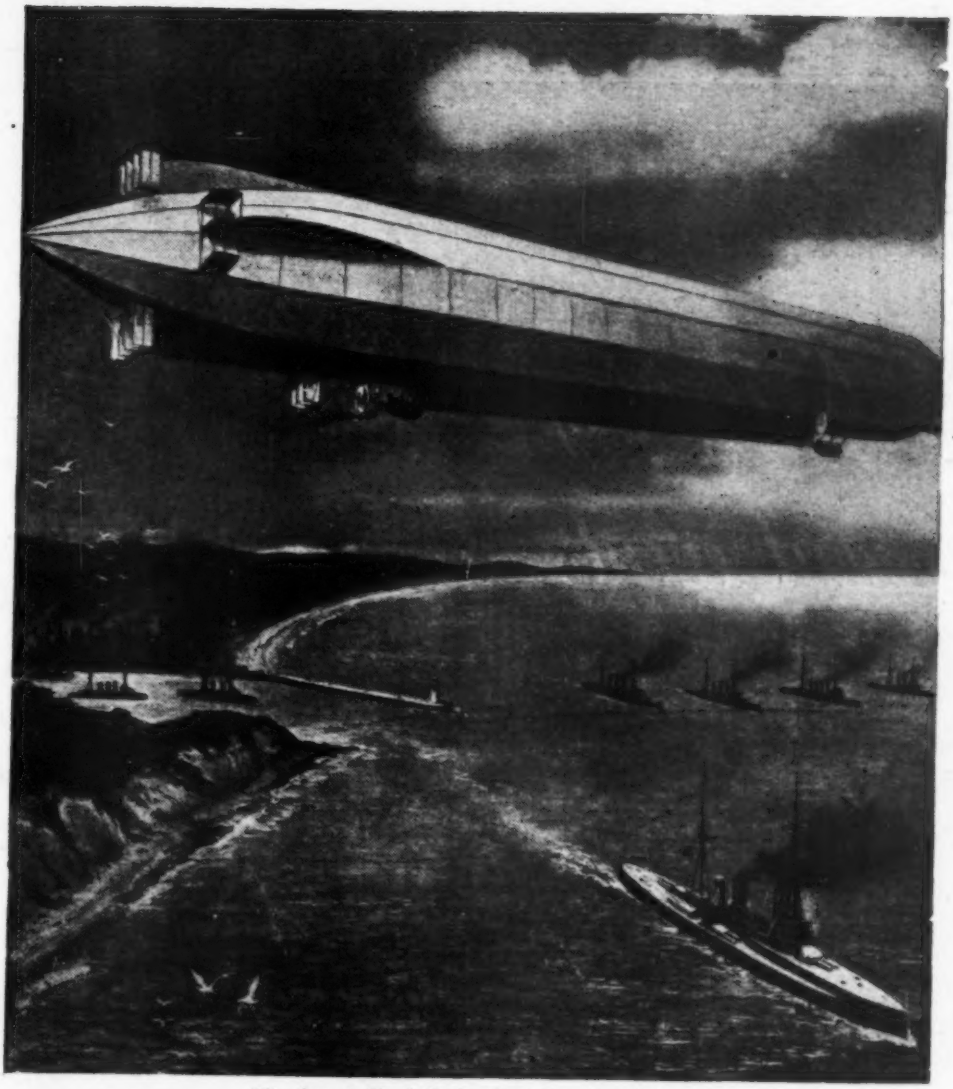
To run through some salient features of the progress, the first American raid was made on Rouen on August 17th, 1942, and only twelve Fortresses were able to take part in it. On October 9th of the same year 108 machines, mainly Fortresses, but including some Liberators, attacked Lille. The author admits (p. 92) that this début of the Liberators was not particularly brilliant. Of all the early attacks on Occupied France he says that too many missiles fell outside the target area, and since they were falling on French soil nobody was happy about it. "Judged by European standards," he writes, "the bombing in those early days was extraordinarily accurate. Judged by American standards it was not good enough." It was found, in fact, that bomb-aiming in combat conditions was a different matter from practice bombing in peacetime.

It must be remembered that the Americans were experimenting with daylight bombing—"an untried theory of air warfare," as the author calls it. Technical modifications had to be made in the machines as experience was accumulated. The crews found that they needed more fire power forward, better oxygen supply for the turrets, better organisation of the crew, and better equipment for abandoning aircraft, dinghies, etc.

In the raid on St. Nazaire on January 3rd, 1943, individual bombing by each crew was abandoned in favour of mass release on a signal by the leader. The raid on Bordeaux on May 17th, 1943, was made by a force composed entirely of Liberators, and led to the conclusion that better results were obtained when a combat force was composed entirely of one type, either Fortresses or Liberators. Incidentally, it is mentioned that the name "Liberator" was an idea of the R.A.F., chosen with the idea of appealing to enslaved nations. At the end of July Thunderbolts were equipped with long-range tanks, and the Americans became convinced believers in fighter escorts for daylight raids. In fact, they had wanted long-range escorts long before any could be supplied.

The steady development of the force available to bomb Germany was interrupted in various ways, probably not realised by the man in the British street. In October, 1943, two squadrons of Liberators were sent to work with Coastal Command. In December three squadrons of the same type were sent to Africa, and stayed there for three months, during which time they raided Ploesti. A little earlier two whole groups of Fortresses (the most experienced) had also been sent to Africa, and they remained there permanently as part of the 12th Air Force. The 8th Air Force had no easy march to its present state of power and efficiency.

The author is generous (though that is not quite the word) in his acknowledgment of Reverse Lease-Lend, and the help which the R.A.F. was always ready to give. We must also note that the brochure is profusely illustrated, and that the description by an officer of the air battle on the Regensburg raid (August 17th, 1943) is one of the most vivid pieces of descriptive writing that we have come across for a long time.



The first airship built for the Navy, launched at Barrow-in-Furness, May 22nd, 1911

WHEN WE WERE YOUNG

Nineteen hundred and eleven saw also the launching of Cellon; but that was not a matter of public interest. Yet though it could not be foreseen at the time, it was a matter of national interest, for Cellon is playing no small part in the country's war effort. The industrial progress of the past thirty-two years is reflected accurately in the development of Cellon.

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In the light of current events

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Behind the Lines

Service and Industrial News from the Inside of Axis and Enemy-occupied Countries

Japanese Aircraft Output

WASHINGTON has estimated that Japanese factories are turning out aircraft at the rate of 1,200 per month, and reports indicate that, like the Germans, they are now concentrating on fighters for defensive action.

Comment

THE German radio quoted by Reuter gave the following comment on Allied air attacks: "In their daylight air offensive against the Continent, the Anglo-Americans are using all possible operational devices. Streams of enemy bombers are coming in simultaneously from the west, north and south in a bid to split up the German defences. They make feint attacks to deceive our fighters, so that the main force of the enemy bombers may get through to their targets unhindered."

Correction

OWING to a typographical error in a message received a paragraph in this feature in *Flight* of December 23, 1943, referred to the operation of a Swedish airline between Stockholm and "Vichy."

This should have read "Visby" (Sweden).

Complaining

GERMAN generals in command of the German air defences were criticised by the Berlin paper *Deutsche Allgemeine Zeitung*, for in an article about the air war quoted by the German Overseas News Agency, the paper said: "The men in command of the German air defences must learn to be quicker. They must try to use an intuitive tactical instinct which will permit them to predict which tactics the enemy raiders will employ on any given occasion. The Anglo-American bomber chiefs are always using new tactics in their attacks on Germany, and if one of these tactics proves to be unsuccessful it is dropped at once and replaced by a new method of attack."

Fuel Gauge

A REPORT published by the German Institute of Aeronautical Research (*Deutsche Versuchsanstalt für Luftfahrt*), of Berlin-Adlershof, describes an aircraft fuel gauge which is largely immune from changes of position and acceleration, and whose minimum accuracy of indication amounts to ±3 per cent. of the total fuel capacity of the tank at accelerations up to 2g and positional changes up to 30 deg. from the horizontal. The measuring principle consists of comparing the weight values of the fuel tank with those of a small comparative weight; both are suspended from springs, the constants of which are selected to make the elongation of the springs of the same order. The elongation depends upon the acceleration and positional change in an equal degree, so that their quotient provides an independent measure for the proportional weight of the two masses.

In order to save weight and space, an electric measuring device is employed; this measures the changes in electric resistance of wires when stretched within their limits of elasticity. The fuel tank is mounted in the aircraft as usual by means of metal bands, the tightening screws of which are housed in the measuring elements. The rate of elongation of the spring located in the measuring element amounts to about 0.05 mm. for a load of 100 kg. (220lb.), and is transferred to constantin measuring wires which are mounted between two amber insets in such a way as to relieve them when the load on the measuring element increases. This eliminates the occurrence of excess loads, and the initial tension can be so selected that it roughly amounts to the elasticity limit of the wire when the tank is empty. By this means the measuring value (ratio of change in electric resistance to change in load) reaches its optimum value, and, at an initial resistance of 36 ohm, amounts to about 60 by 10^{-3} ohm for each 100 kg. of load.

The measuring elements of the comparative weight contain a ball weighing about 30 grams which is suspended from a constantin wire and guided laterally, and a length of wire of similar dimensions but unloaded for the purpose of obtaining immunity from temperature changes. The proportion of the comparative mass to the maximum fuel mass is 1 to 15,000.

What They Say

FIELD-MARSHAL ERHARD MILCH, German Under-Secretary of State for Air: "February, 1944, has brought a change in the war in the air. The British share in the European air front has gradually declined compared with the American air effort. Discounting nuisance attacks the American Air Forces have flown ten major attacks against German towns in February as against five British. At the same time night attacks have changed to attacks by day.

"It must be the main task of the *Luftwaffe* and German aircraft production to offset the American production capacity. Whether we have been successful in this task the future will show. Both in quantity and quality German air power has reached a never before suspected peak."

A German military spokesman, quoted by German radio: "During past months the essential task of the *Luftwaffe* has been to match increased Allied aircraft production. This problem has been solved, both in quality and quantity."

Jean Herold Paquis, Paris Radio Military Commentator, quoted by Reuter: "The Allied air offensive, having gained in weight during the last few days, has now reached a scale on which it can be regarded as the preparation for an offensive on the ground. Though spring and summer will bring hard times for us, we can remain confident, for victory will not be won in the air. It will have to be fought for on the ground."

Dr. Rudolf Semmler, German Radio Political Commentator: "The fact that Anglo-American air forces suffered such heavy losses over Germany last week—they lost, in fact, about half their combined monthly output of heavy bombers—does not mean that they cannot afford to continue these mass raids. They will have reached the limit of what they can afford only when we go on forcing them to use up their reserves—and this is what we are doing."

A parade at the Nancy training centre for aircraft specialists. Although the poster proudly proclaims that the future is in the air—the miniature Junkers trade mark on the left-hand poster gives the game away.

NEW ROLLS-R

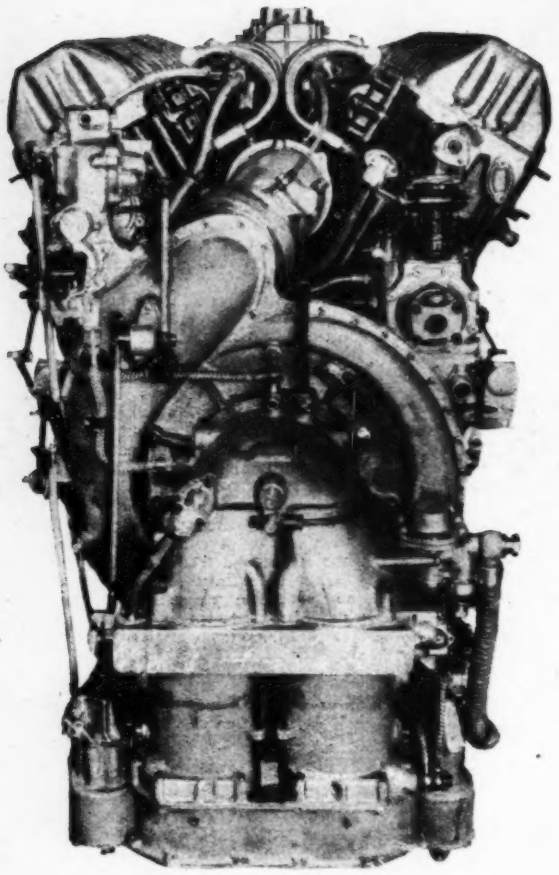
36.7 LITRE 12-CYLINDER ENGINE LI
COMPACT SUPERCHARGER AN

IT is now permissible to reveal that yet another Rolls-Royce engine is in operational service with the R.A.F. Known as the Griffon, the new engine is a twelve-cylinder liquid-cooled Vee type, and is in the 2,000 h.p. class. This new bird of prey which follows the Hawk, Falcon and Eagle of the first world war, already, by its amazing performance, has become a worthy contemporary of the Merlin—incidentally a bird of the Falcon family.

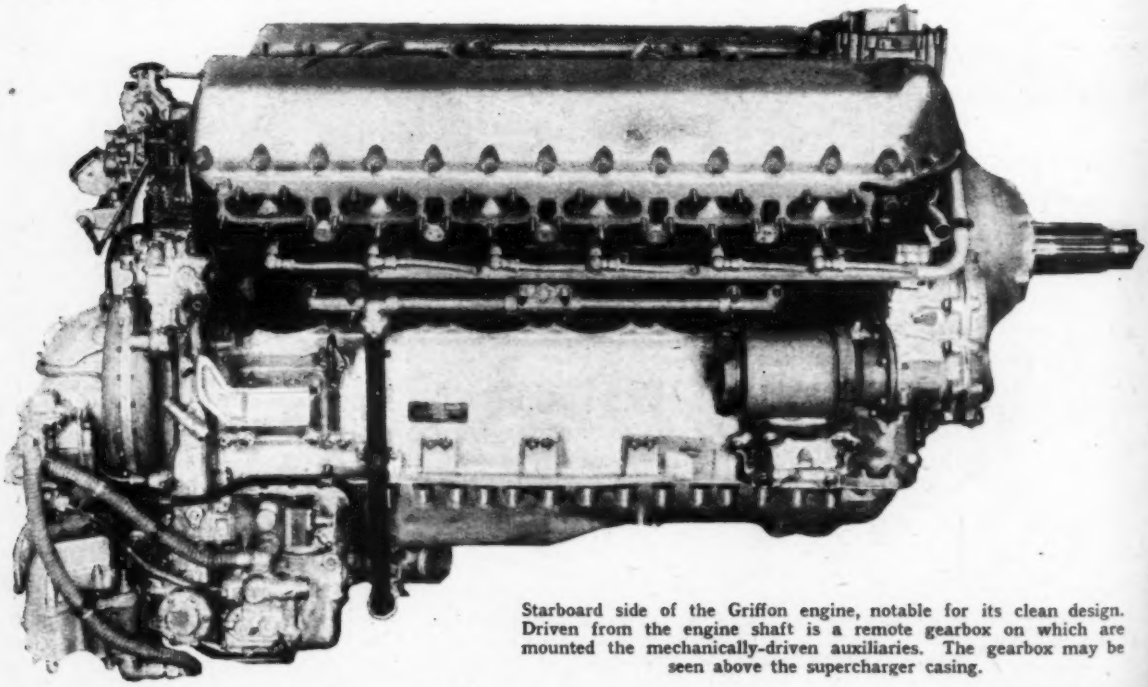
The Griffon is larger than the Merlin, having a cylinder bore and stroke of 6.0 by 6.6 inches respectively, which give it a capacity of 36.7 litres against 27 litres of the Merlin, that is, 23 per cent. increase.

Although an entirely new product, it is of the same cylinder arrangement and dimensions as the "R" type Rolls-Royce which won the Schneider Trophy in 1931. The experience gained with that engine, coupled with the Merlin engine, which is produced so successfully in its thousands, has enabled Rolls-Royce engineers to evolve a unit already proved in reliability and high power generation. In this connection it may be recalled that the "R" type engine of 1930 still remains the outstanding engine of all time. Produced especially for this comparatively short-distance it completed a one-hour endurance test without the slightest trouble, developing 2,350 b.h.p. for a total weight of 1,630 lb. or 11 oz. per b.h.p. Its normal speed was 3,200 r.p.m.

Later the "R" engine was used in a successful attack upon the world's speed air record. With Flt. Lt. Stainforth at the helm the record figure of 408 m.p.h. was attained. At one period the engine held the world's land, water and air speed records.



Supercharger end of the new Griffon—the largest of the Rolls-Royce range. Its compact design will be appreciated.



Starboard side of the Griffon engine, notable for its clean design. Driven from the engine shaft is a remote gearbox on which are mounted the mechanically-driven auxiliaries. The gearbox may be seen above the supercharger casing.

S-ROYCE GRIFFON

ENGINE LIQUID COOLING : REMARKABLY GER AW SYSTEM OF CARBURATION

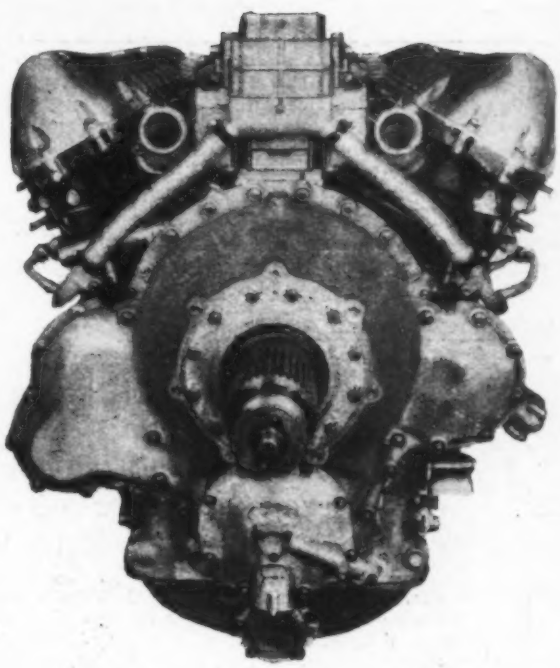
Naturally, production-type engines from which reliable service is demanded over lengthy periods could not, at that time, be expected to attain such astounding figures, but the march of time and progress of recent years in supercharger design, metallurgical problems and fuel have served to eliminate one by one the obstacles in the way.

As fitted to the Spitfire, the Griffon engine has a two-speed mechanically driven supercharger of the same general type as that fitted to the Merlin XX engine which gives it an outstanding performance, not only at low altitudes, but also at heights between 15,000 and 25,000ft., in which region very many combats take place.

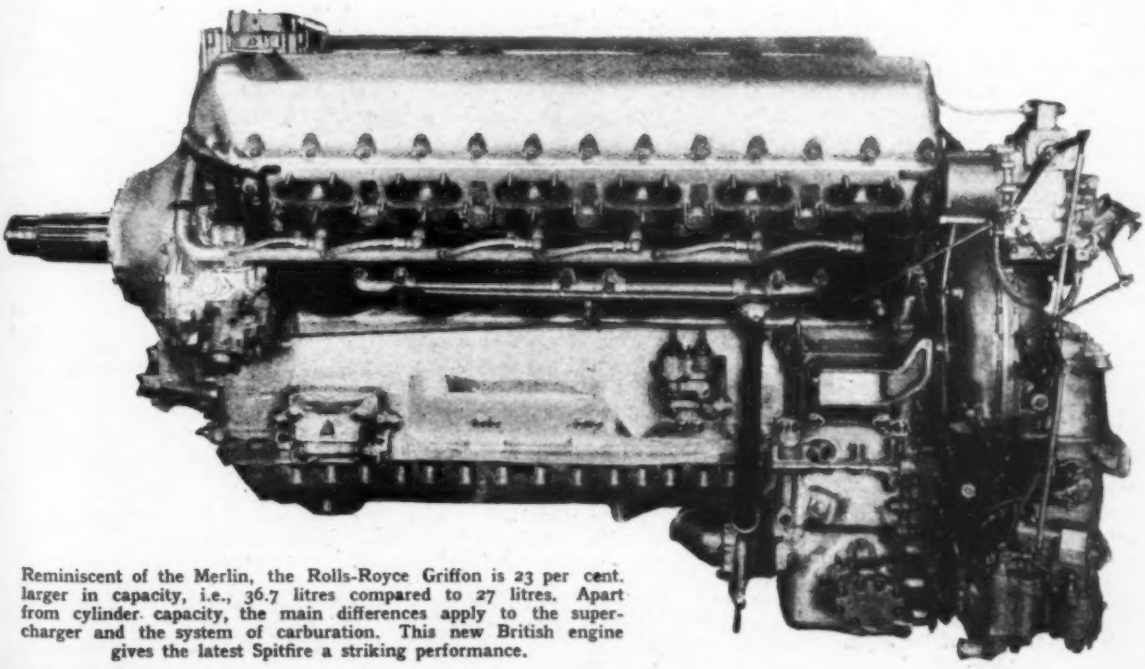
Auxiliary Drives

An interesting feature of the Griffon not usually found on engines in fighter aircraft, is the provision of a remote gear box, shaft-driven from the engine, on which are mounted the mechanically driven accessories required to operate the retractable undercarriage, the wheel brakes and wing flaps, blind-flying instrument panel and the generator for the wireless installation. Normally these accessories are mounted on the engine wherever arrangements can be made to drive them, but it will be obvious that the provision of an independent gear box makes for simplification of engine and accessory installation and their subsequent maintenance.

It will thus be appreciated that the newest British aircraft engine is neither a modification of the racing engine nor a stepped-up Merlin. Rather it should be described as an engine representing the accumulated experience of two of the most notable aero engines the world has known. The choice of cylinder arrangement and size from the "R" engine must have been a happy one for the purpose of producing immense power from an engine of small overall dimensions, whilst prolonged experience with the Merlin assisted materially in providing the en-



Another view demonstrating the extraordinary compactness of the design. Its very small frontal area is a great advantage in fighter aircraft. The reduction gear is an improvement on the Merlin.



Reminiscent of the Merlin, the Rolls-Royce Griffon is 23 per cent. larger in capacity, i.e., 36.7 litres compared to 27 litres. Apart from cylinder capacity, the main differences apply to the supercharger and the system of carburation. This new British engine gives the latest Spitfire a striking performance.

NEW ROLLS-ROYCE GRIFFON

during qualities so important a problem with an engine of high power and light weight.

The new Griffon is a masterpiece of compact design; indeed, it is extremely difficult to determine immediately whether the latest Spitfire has a Griffon or a Merlin engine, for the reason that it has been found possible, notwithstanding the increased cylinder dimensions and power, to apply the engine without structural alterations to the airframe. One of the illustrations shows that the design of the supercharger and the system of carburation has been considerably amended and made still more compact.

The engine, too, reveals that two-stage supercharging is not employed on this particular example, as there are no signs of an intercooler.

In these days when high-powered units are so badly needed the advent of the Rolls-Royce Griffon marks a notable advance in aero engine design. G. S.

Indicator Discusses Topics of the Day

Sorting Out the Snags

Dealing with the Inevitable Unreliability of the Modern Aircraft : Science versus Ingenuity : When the Experts are Floored : Mechanical Snag-hunters

TO the average person's mind, an aircraft is like a car or a locomotive—just something that goes on and on until, perhaps, it requires an overhaul after a definite number of hours in the air. Up to a point, that is quite true of many of the individual items, but it is most certainly not true of the machine taken as a whole. Some better-known engines, for instance, can be left alone for very considerable periods, and a modern airframe—to use a Service word—may be left about in the open more or less indefinitely. Maintenance people must sometimes wish that an aircraft consisted only of an engine and an airframe.

In fact, the present-day flying machine is, in detail, just about the most unreliable thing that has ever been made unless it is maintained with day-to-day precision. It will nearly always fly, but its mere ability to fly doesn't count for very much nowadays, and operators, whether Service or civil, have had to set up a most complicated organisation of technical and semi-technical people in order to make sure that their aircraft not only fly but continue to do so with the utmost reliability in all conditions. Very few individuals outside the flying world realise just how great a proportion of man-hours are required for every aircraft if it is to be kept in the air day after day.

For the most part, the snags that have to be cleared up all the time are not vitally serious ones. It may be found, for instance, that the starboard hydraulic pump has sheared during the previous day's flying, or that certain haywire characteristics have been reported in the operation of the directional gyro. There *is*, admittedly, another hydraulic pump, and a perfect gyro may not be vitally necessary for flying on the day in question, but a line must be drawn somewhere, and it would be quite hopeless if items of even much less importance were allowed to remain unserviceable.

90 per Cent. Maintenance

So the operator must have a servicing organisation which is absolutely water-tight and must carry a stock of spares, both of complete aircraft and bits, which will remove entirely the possibility that a service will fail to run, or a job fail to be carried out. Maintenance has really become more than ninety per cent. of the business of flying. For every single person there may be in the aircraft itself, there are hundreds on the ground. When and if the airline system of the world becomes as far-reaching and complete as the optimists would have us believe it will, the airfield and aircraft servicing organisation will be the most immense and expensive thing that has ever been known in the history of the world's technical development. Aircraft bits are necessarily expensive and the sort of technical personnel who know how to deal with these bits need to be both well-trained and well-paid; or they should be.

What is wanted most of all nowadays is a series of short cuts to operating efficiency. Instead of letting a bunch of experts scratch their heads for hours and have everything in the world pulled to pieces at great expense when a mysterious snag has developed, we should have a series of test rigs which will, once and for all, discover the cause of the trouble and so save an immense amount of time and trouble. Such rigs are now available for dealing with certain individual items, but they are usually of the laboratory standard and are intended to be used on the suspected item *after* this has been removed from the machine. We need rigs which can be hauled up to the aircraft while it is on the tarmac and while the crew are still discussing the ailment and its points of diagnosis.

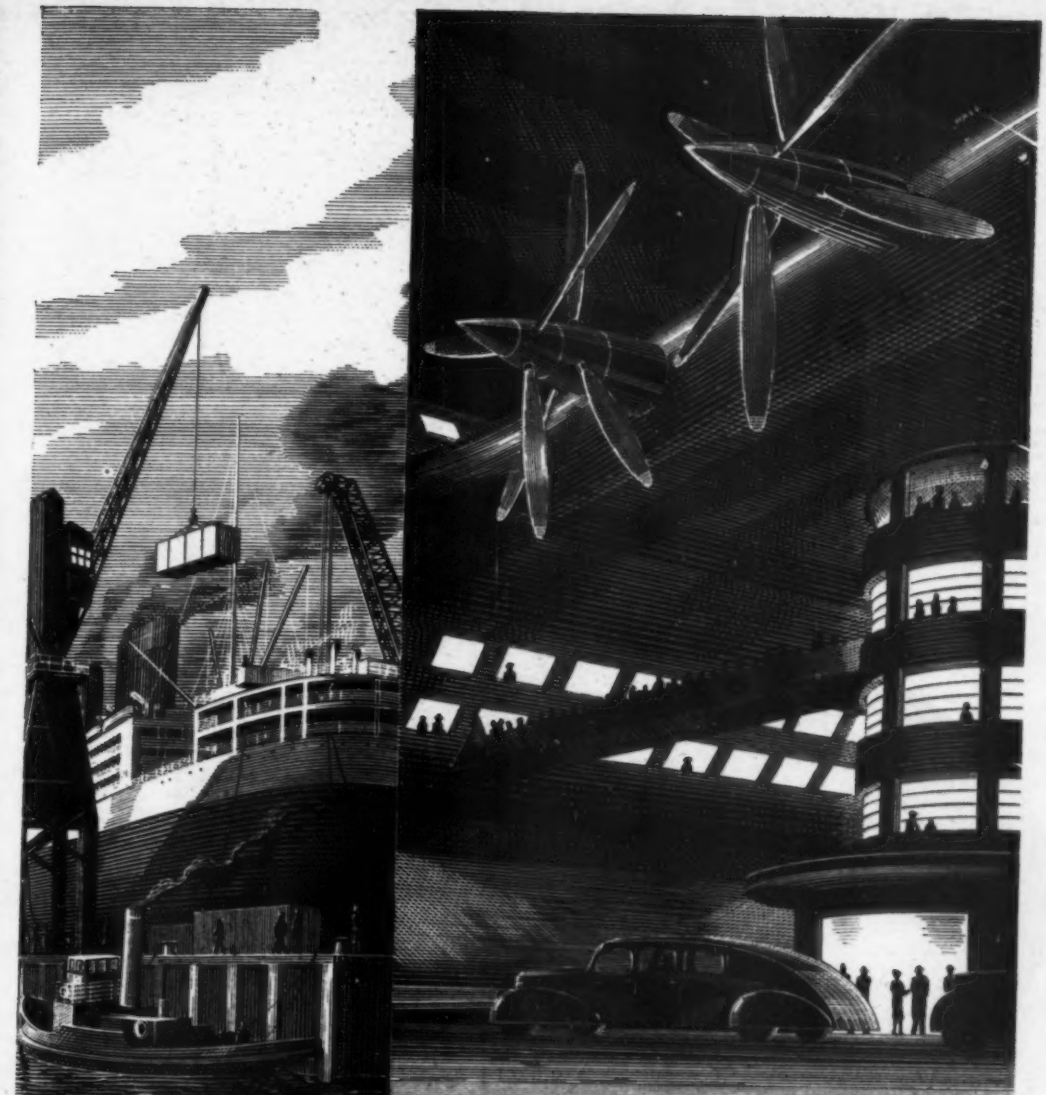
Using Test Rigs

Hydraulics, electrics and instruments we shall always have with us, and most of the minor ailments in aircraft come under these headings. Test pilots have evolved, by experience, various means of boiling down the basic sources of troubles from these causes, but we are dealing with the ordinary run of pilots and crews whose stories may be just a little vague and who have not developed the habit of going into the problem while they are still in the air. And, in any case, some troubles cannot be diagnosed with immediate accuracy by even the most experienced test pilots or snag-hunters.

One can cite dozens of examples, starting with the simplest of all—the suspect air-speed indicator. The instrument can be taken out and calibrated, the pressure head can be taken off and checked, the lines can be blown through—but no one is quite certain, unless a definite error has been found in the instrument itself, whether the trouble has been cured until a test flight has been made.

The ordinary pilot might notice that the gyro horizon is a bit slow in building itself up and is not too accurate in the air; he would snag the instrument. A pilot who has made a study of such things might also notice at the same time that the directional gyro "topples" a little too easily and that the rate of turn shown on the turn indicator is rather less than usual. For him the cause of the horizon's peculiarity would immediately be rediagnosed as a partial failure in the vacuum system as a whole, while the less interested pilot would concentrate his disfavour on the one instrument which appeared to be giving most trouble.

The indicated maximum controlled revolutions of the



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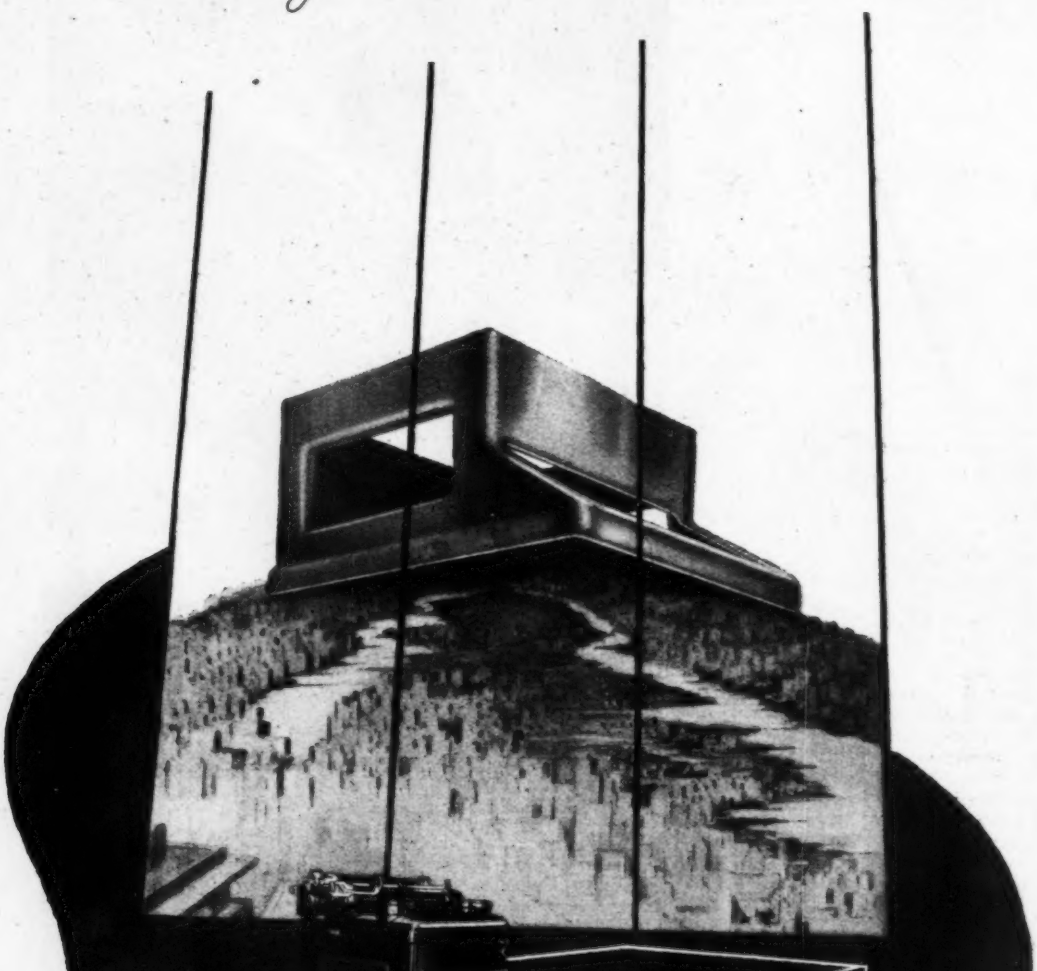

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SORTING OUT THE SNAGS

port engine might be fifty or so down. Usually it will mean that the instrument is faulty or the generator is dirty, but the c.s. stop might have slipped and the revolutions of that engine may really be down. The test pilot would match the engine synchronisation by ear and note the readings of the two dials; if, throughout the range, the port indications are lower, then it is reasonable to suppose that the instrument is slightly out. Even so, what portion of the layout, from the instrument itself to the drive from the generator on the engine is faulty? At present, one thing is tried at a time.

As I say, one can go on giving examples almost for ever, and I have produced by no means the best or most interesting ones. There is far too much hit-and-miss about snag-hunting in aircraft, and the introduction of some really fault-proof series of universally applied rigs for different items would save a great deal of unnecessary thought and work. The naturally mechanical pilot may hit on the cause of the trouble immediately and will at least give a coherent and intelligent account of it. The naturally intelligent fitter or rigger will jump to the possible causes when he is given the slightest items of evidence. But we have to deal with the non-mechanical pilot and with the groundsman who either fails to listen, or who, from habit, puts everything down to "cockpit trouble." Like the annoying chap who, after one has struggled in for miles on one motor, comes forward with the bright suggestion that the trouble is really only an unserviceable boost gauge.

There *are* plenty of bright and ingenious people, but the proportion is numerically low, and there is no reason at all why the bright people shouldn't be assisted as far as possible by mechanical means if these are available. The other week I heard a story of true natural ingenuity in an individual. He was flying a single-engined aircraft somewhere near the coast of Iceland, when he realised that he wasn't at all certain in which direction land lay. I can't remember whether his compass had gone queer or whether he wasn't sure which side of the enormous island he was near. At any rate, he found a flock of sea-birds sitting around on a fishing expedition, and conceived the idea of frightening them into continued flight and noting the direction in which they went. It seemed likely that they would head towards their nesting place and he hoped this wasn't in the Hebrides, Courland or the Faroes. Sure enough, after one or two attempts, they lost patience and set off for home. He got back. The story is not to be confused with that apocryphal one about the pilot who examined the cows in the field, saw they were all facing one way and deduced that they would be standing with their backs to the wind. Unfortunately, they were a breed of cow which always stood head to wind when it is cold and wet. When I look at cows they're all facing in different directions or sheltering under trees.

"Indicator."

Radio in the R.A.F.

LITTLE has been published, during the present war, about the part played by wireless and radio equipment in the R.A.F., and while it is obvious that security considerations forbid anything in the nature of a detailed description of either the various kinds of equipment used or the precise nature of its employment, it is now permitted to publish a few broad generalities on this highly specialised subject.

In the first place, the equipment itself has to fulfil certain vital requirements from the purely operational viewpoint. It must operate in aircraft flying at high altitudes under decreased atmospheric pressure, and it must be just as efficient at the Equator as in the Arctic. It may have to be used on the ground in steaming jungles, on dusty plains, or amid desert sands. Thus every radio set for the R.A.F. is first put through an operational test in temperatures ranging from −30 deg. to +60 deg. Centigrade, after which it is tested in special low-pressure chambers. Robust build and fool-proof efficiency are likewise essential, and much research and development have gone into the production of materials and components capable of standing up to these exacting conditions, for the success of an operation may depend upon the successful working of radio. Records show that in a recent month the wireless transmission failures throughout the whole of Bomber Command were less than one per cent.

W/T and R/T Sets

Ground radio equipment, of course, is subjected to the same searching tests as the transmitting and receiving sets designed for use in our fighters and bombers.

A standard general-purpose wireless telegraphy (W/T) set is used for all high-frequency W/T purposes in all bomber, general reconnaissance, training and transport aircraft at home and overseas. This equipment is required in tremendous quantities. Radio telephony (R/T) facilities are provided by two main R/T sets. Fighters, heavy and medium bombers, and close-support aircraft are equipped with a very high-frequency R/T set. The bombers communicate with their bases on their long-range W/T set, and use their R/T for communications between aircraft (*including escort fighters*) and for receiving landing instructions from the airfield control towers.

All aircraft radio equipment has to be as light and small as possible, consistent with strength and durability. The entire fighter installation, for instance, including the power supply, weighs only about 90 lb.

In the larger types of aircraft, more wireless equipment is essential. It includes (a) a general-purpose W/T set manipulated by the wireless operator; (b) a pilot-operated high-frequency R/T set; (c) a Beam Approach receiver, operated by the pilot, which enables him to make a safe approach to an airfield in conditions of bad visibility; (d) a Direction-Finding (D/F) loop—the responsibility of the wireless operator—which makes it possible for the aircraft to "home" on to any medium frequency transmission; and (e) an intercommunication amplifier, linking up all members of the air crew.

Second Front Requirements

An interesting comparison is the gigantic radio apparatus at a main airfield—almost a wireless "station" in itself—and the mobile radio equipment. The latter is probably the most remarkable development in the whole vast system of R.A.F. communications.

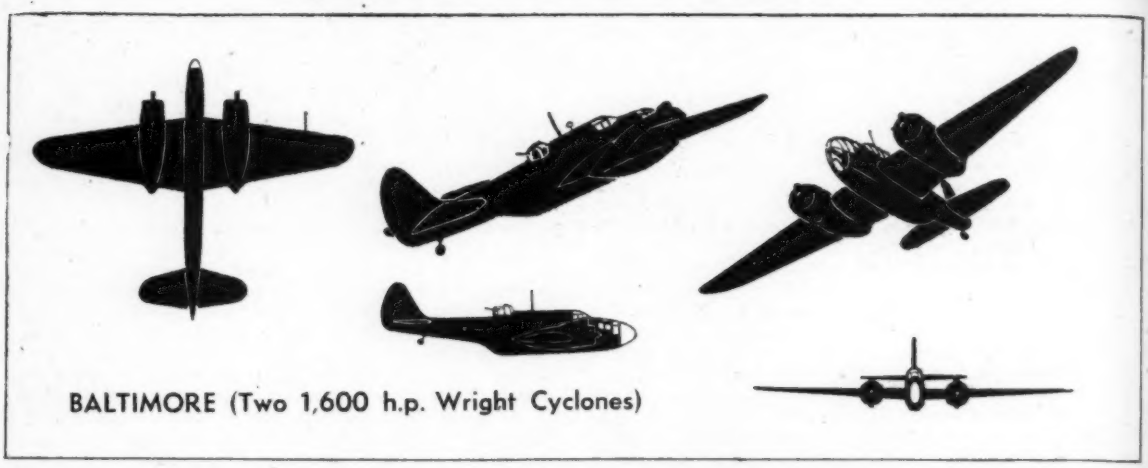
For the Second Front operations, mobility is extremely important, and every type of communication can now be provided by mobile stations mounted on vehicles, ranging in size from light vans to five-ton trucks. A unit, known as a "Heavy Mobile Wireless Station," employing diversity receivers and a transmitter with an aerial power of 5 kw., provides high-speed W/T communication. These units can be put into operation within a few hours of landing, and can handle a vast quantity of "traffic" between the operational command concerned and the home bases.

Mobile equipment covers requirements for high frequency communication between ground and aircraft; and/or very high frequency D/F stations. Even transmitters with an aerial power of 10 kw. have been successfully made mobile. By this wide adoption of W/T communications, the R.A.F. is able to operate without the use of landlines, which are seldom available in the early stages of a campaign, and cannot be supplied in sufficient quantities for some time after the occupation of new territories.

Another type of set which no doubt will play its part in forthcoming operations is the pack set.

Studies in Recognition

Aircraft in R

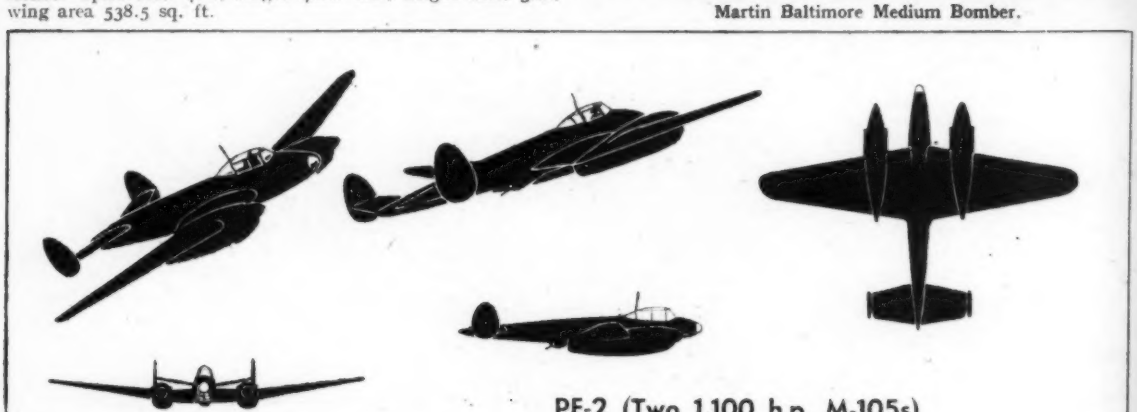


BALTIMORE (Two 1,600 h.p. Wright Cyclones)

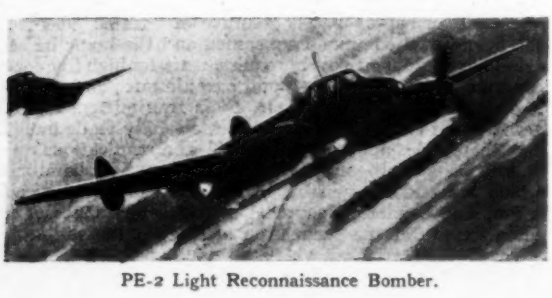
DESIGNED especially to the requirements of the R.A.F. in the Middle East, the Martin Baltimore is still giving excellent service in the Mediterranean theatre. It is powered by a pair of 1,600 h.p Wright Cyclone engines and has a top speed of 298 m.p.h. at 11,600ft. Armament consists of eight 0.3in. machine guns, four in the wings, two in the dorsal turret, and two in the ventral position behind the bomb bay, which accommodates a 2,000 lb. load.

Recognition points include tapered mid-wings with round tips, webbed nacelle extensions on the trailing edge, large, low aspect-ratio tailplane with blunt round tips, large rounded fin and rudder, deep narrow fuselage with transparent plastic nose, but stepped down aft of turret and bomb bay. Dimensions:—Span 61ft 4in., length 48ft. 6in., height 16ft. 3in., wing area 538.5 sq. ft.

Martin Baltimore Medium Bomber.



PE-2 (Two 1,100 h.p. M-105s)

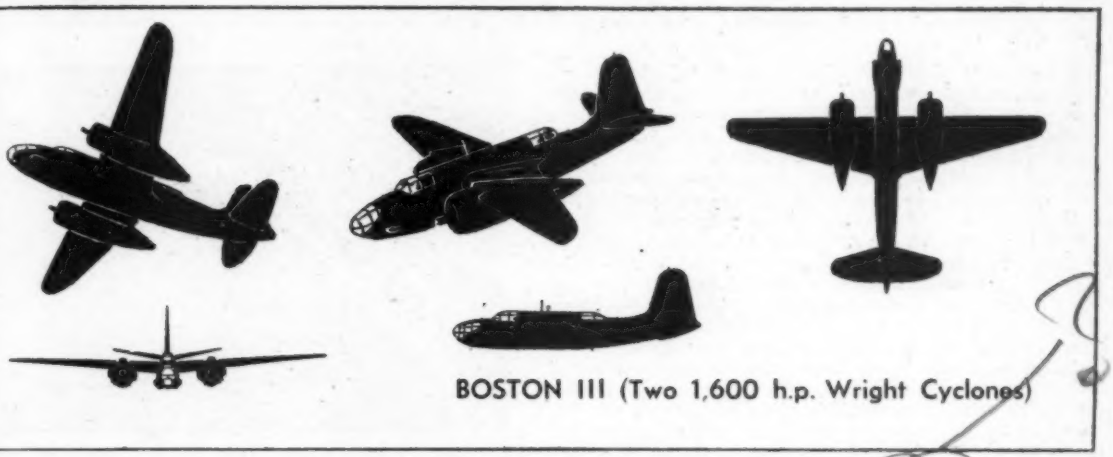


PE-2 Light Reconnaissance Bomber.

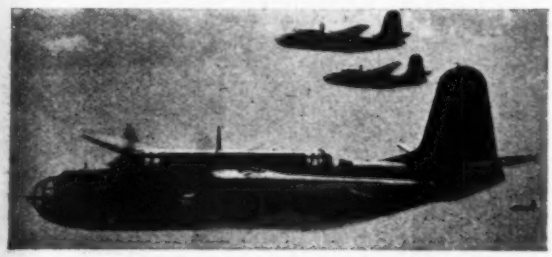
WIDELY used by the Russian Air Force, the PE-2 light reconnaissance bomber is powered by a pair of M-105 V-type liquid-cooled engines, each developing 1,100 h.p. Its top speed is about 300 m.p.h., and it can carry an internally stowed bomb load of 1,700 lb. Armament comprises two machine guns in the nose, and flexible guns at the rear of the cockpit enclosure, and in a ventral position aft of the bomb bay.

The fuselage of the PE-2 is reminiscent of the Mosquito, but its low wings taper uniformly on both edges, the outer panels having pronounced dihedral outboard of the thick tapered centre-section. A tapered, low aspect-ratio tailplane also has dihedral angle and carries egg-shaped, endplate twin fins and rudders. The heavy, three-quarters underslung nacelles extend behind the trailing edge. Approximate dimensions:—Span 60ft., length 45ft. 6in., wing area 592 sq. ft.

ing Attitudes



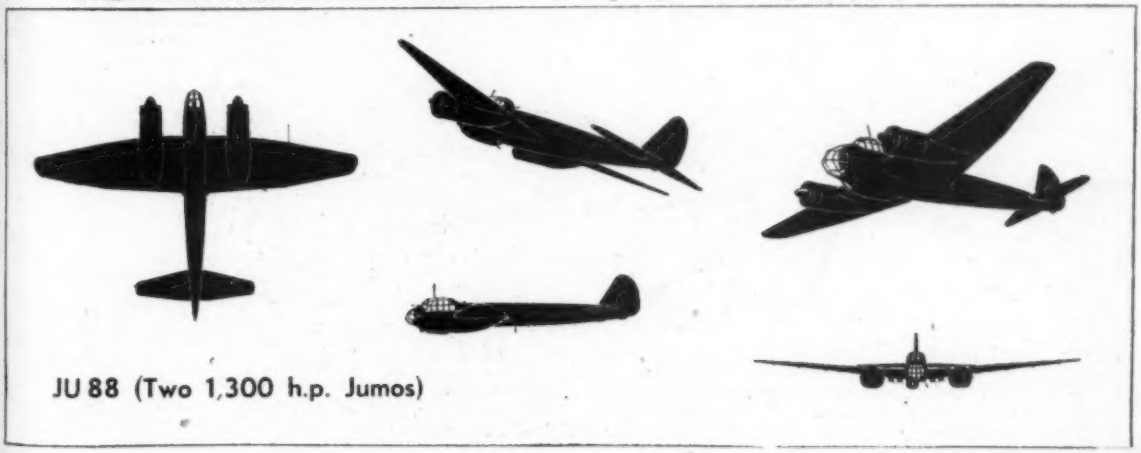
BOSTON III (Two 1,600 h.p. Wright Cyclones)



Douglas Boston III Medium Intruder Bomber.

THE Douglas Boston III is powered by two 1,600 h.p. Wright Cyclones. Top speed is 291 m.p.h., and although its bomb load is no more than ½ ton, it has an "intruder" armament consisting of four 20 mm. cannon under the forward fuselage, four 0.303in. machine guns in the nose (two in troughs and two in side blisters) and two more at the rear of the long raised fuselage top.

Recognition features include high mid-wings with straight leading edge, forward swept trailing edge and small round tips, tapered tailplane with curved trailing edge and marked dihedral angle, tall fin and rudder with blunt round apex. Heavy underslung nacelles extend behind the trailing edge. Deep narrow fuselage, raised in centre, long nose, and tricycle undercarriage. Dimensions:—Span 61ft. 4in., length 47ft., height 15ft. 10in., wing area 465 sq. ft.



JU 88 (Two 1,300 h.p. Jumos)

THERE are a dozen or more versions of the notorious Junkers Ju 88, but the one illustrated is the Ju 88A-6. It is powered by two 1,300 h.p. inverted V-type liquid-cooled Jumo engines with circular nose radiators. Racks beneath the centre-section increase the maximum bomb load to 4,400 lb., and the armament comprises a 15 mm. cannon operated by the pilot, a flexible 7·9 mm. machine gun in transparent nose, two more at rear of cockpit cover and a fourth in offset blister under the nose. Top speed is 287 m.p.h.

Recognition points include low wings with increased taper to outer panels and small round tips; high aspect-ratio tapered tailplane; large single fin and rudder with curved trailing edge; "snake's head" fuselage and prominent cylindrical nacelles. Dimensions:—Span 65ft. 7in., length 47ft., height 15ft. 5in., wing area 583 sq. ft.

Junkers Ju 88A-6 Multi-purpose Bomber.

BOUNDARY LAYER CONTROL

GREATLY IMPROVED PERFORMANCE AS A RESULT OF REDUCTION IN DRAG : INHERENTLY APPLICABLE TO JET-PROPELLED AIRCRAFT

THE very simple principle of the turbine makes it a most desirable power unit for many forms of propulsion. In addition to this inherent quality, there is immense contributory benefit to be derived from the employment of a type of power unit for aircraft which permits a design of excellent aerodynamic form, devoid of excrescences which create parasitic drag and air flow turbulence. The turbine-compressor is such a unit; it is compact, self-contained and of convenient cylindrical shape.

In the consideration of an aircraft equipped with a turbo-unit, the necessity for providing an air intake for the turbine can be turned to advantage by arranging the intake inlet to exert an influence on the boundary layer air flow. This may probably require amplification and so a brief description of what this layer consists may be found useful.

The boundary layer is that region adjacent to the skin of the aircraft where particles of air are in a transitional stage of acceleration up to the speed of the air flow past the aircraft. This is illustrated diagrammatically in Figs. 1a and 1b. The layer of air immediately next to the skin tends to adhere to it, the layer above that is less able to resist the general air flow, and so on successively until the outer layer of the boundary region is moving at the same speed as that portion of the main air mass flowing past the aircraft. It must be pointed out, however, that the phenomenon is by no means quite so simple of explanation as this; there are numerous factors which influence boundary layer characteristics, and the composition of the layer itself is also subject to variation. The description above is, at best, very general, and anything further than this is both beyond the scope of, and out of place in, an article of this nature. Readers who desire to investigate this aspect of aerodynamics for themselves are referred to Warner—*Airplane Design* (*Performance*); and Dodge and Thompson—*Fluid Mechanics* (from which Figs. 2, 3a and 3b are taken).

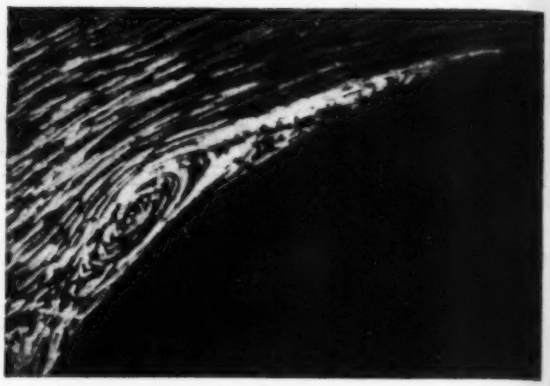


Fig. 2. Boundary layer flow near the separation point on a circular cylinder.

The resistance to motion through the air for any aircraft can be considered as being made up to two quantities, (a) the effect of viscous shearing stresses in the air, the resultant being known as skin-friction, and (b) the drag caused by the formation of a turbulent wake. The shape of the aircraft—fuselage, wings, tail unit, etc.—determines the character of pressure distribution over its entire surface, and with *finely streamlined shapes* the changes of pressure are very gradual, so that separation of flow into turbulence is close to the rear end of the body, and the resulting wake is narrow. The resistance due to (b), in such cases, is only a very small part of the total drag, the remainder being due to (a) as the boundary layer covers almost the entire surface.

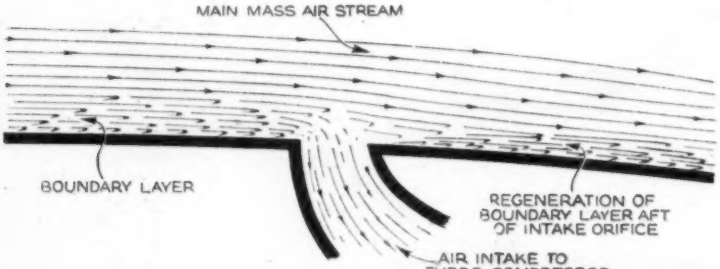

MAIN MASS AIR STREAM
BOUNDARY LAYER
REGENERATION OF BOUNDARY LAYER AFT OF INTAKE ORIFICE
AIR INTAKE TO TURBO-COMPRESSOR

Fig. 1a. Diagrammatic illustration of boundary layer formation and relation to major air stream, showing abstraction into the turbo-compressor of air from boundary region in order to delay the separation point.

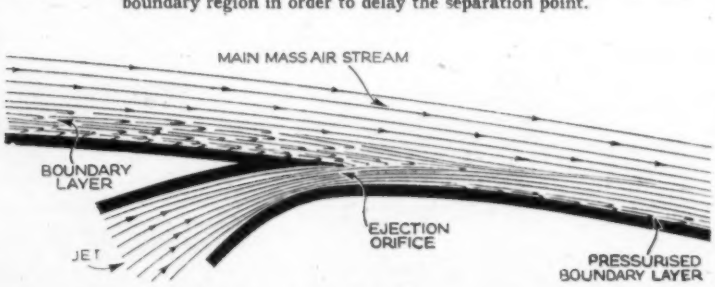


Fig. 1b. This shows the efflux from the turbo-compressor being ejected tangentially to the aircraft skin curvature in order to accelerate the boundary layer air and so prevent separation.

Effect on Mass Flow

Disregarding the physical properties of the air, the depth and growth of the boundary layer is influenced in relation to the curvature of the shape, this curvature being mathematically constructed according to the fineness ratio, i.e., the ratio of length to maximum cross-sectional diameter. However, the break down into turbulence near the separation point in a boundary layer, as shown in Fig. 2, profoundly affects the character of the major air stream flow, and does, in fact, induce a break down from laminar flow into general turbulence in the wake, so that the two quantities (a) and (b) which compose total drag are inter-related.

Boundary layer control, with a view to reducing drag and thereby improving overall performance, has been the subject of a great deal of research and experiment for about 40 years, ever since Prandtl introduced, in 1904, what has become known as his boundary layer theory. As a side issue to this it is of interest to record that the first explanatory theory covering the field of skin-friction was pro-

BOUNDARY LAYER CONTROL

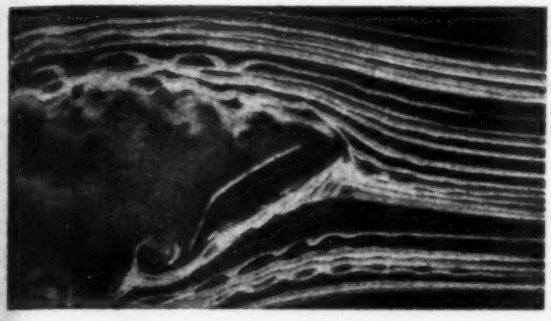


Fig. 3a. Flow of air around a flapped aerofoil at a large angle of attack.

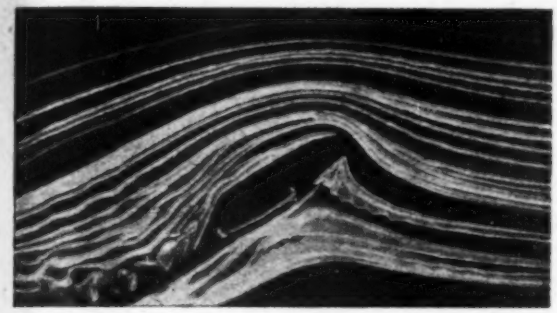


Fig. 3b. The same aerofoil as in 3a but with boundary layer control by suction applied, showing the suppression of break-down into turbulence.

pounded by Dr. F. W. Lanchester in the Aerodynamics section of his work "Aerial Flight." As speeds tend to rise, the application of boundary layer control assumes paramount importance. However, it was not until the advent of the successful jet-reaction propelled aircraft that boundary layer control could be considered a practicable possibility, this type of propulsion being admirably suited to the objective.

The control of boundary layer characteristics aims at reducing the depth increment of the layer and thus delaying the separation into turbulence by either or both of two methods; (i) (introduced by Prandtl) by abstracting air from the boundary layer through slots in the wings and fuselage; and (ii) (proposed by Baumann) by ejecting on to the boundary layer to achieve the same result. The extent to which this can be applied, and the effect, is very clearly shown by Figs. 3a and 3b, the control in this case being achieved by the suction method.

With a jet-propelled aircraft the necessity of providing an air intake for the turbo-unit, and an orifice for the ejection of the jet, present an excellent opportunity for exercising these methods of boundary layer control with the tremendous advantages they bring. In one of his early patent specifications Group Captain Whittle, who evidently was well aware of the possibilities, allowed for the first of these applications, for he suggests having an annular forward-facing intake at a distance of two-thirds to three-quarters of the total length back from the leading end, or in the zone where a considerable depth of boundary layer is found to be present. He also makes provision for abstracting air into the turbo-unit from a series of orifices in the wings.

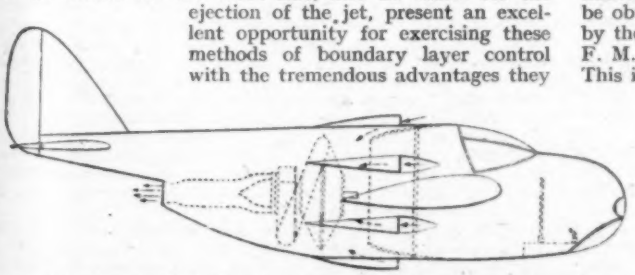


Fig. 4. Reproduction of drawing in patent specification 512064 granted to Group Capt. F. Whittle in 1938. The forward-facing air-intake scoops can be clearly seen together with the tail orifice for the jet.

One of the primary reasons for not having utilised these advantages in orthodox aircraft is the great volume of air to be inhaled and/or ejected. Dr. Warner gives this as being 1.2 cu. ft./sec./sq. ft. of area at a speed of 100 m.p.h., the resulting maximum coefficient of lift being 3.0—an extremely high value. Obviously, in an orthodox aircraft the auxiliary power plant required for this purpose would need to be disproportionately large, but with a jet-propelled machine the main power unit does the job, and the whole aircraft gains thereby. This beneficial effect is one of the chief explanations of the very high performance characteristics possible with an aircraft propelled by jet reaction, notwithstanding the lower efficiency of the turbo-compressor unit, as compared with the orthodox engine/airscrew combination.

Fig. 4 is a reproduction of a drawing in the patent specification taken out by Group Captain Whittle in 1938. As may be seen, the air intake is in the form of radially disposed, forward-facing scoops, which would provide a definite ram effect, but Whittle covers himself in the specification text by stating that in the drawing the extent to which they project into the relative air flow is exaggerated in proportion. That this is, in fact, the case, is confirmed by the investigations carried out by Schrenk, for Warner quotes Schrenk as having found in 1928 that the best method of effecting control of the boundary layer —by the suction method—is by means of simple, wide, flush slots in the surface.

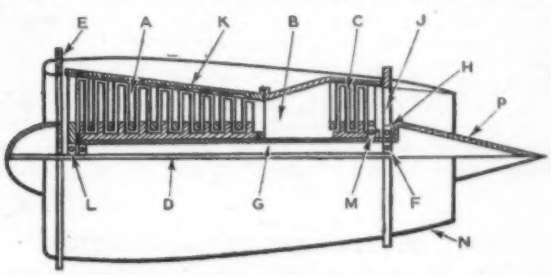


Fig. 5. Bristol exhaust-actuated boundary layer control.

Utilising Waste Exhaust

For the reason stated earlier, the application of such a system to an orthodox type of aircraft would be more limited in its scope. Nevertheless, some advantage could be obtained. This was appreciated in a project sponsored by the Bristol Aeroplane Co., Ltd., A. H. R. Fedden and F. M. Owner, in 1936, shown diagrammatically in Fig. 5. This is of interest as it employs the energy of the exhaust gases from a normal engine, which would otherwise be lost, to suck in the air from the boundary layer over part of the upper surface of an aerofoil. No demand is made on the power output of the engine and no auxiliary source of power is required.

A radial engine driving an airscrew is mounted forward of the leading edge of the wing of what is apparently a very large aircraft. The exhaust gases are collected in a ring A, located at the leading edge of the engine cowling, and delivered by a tail pipe B to a mixing chamber C. The

BOUNDARY LAYER CONTROL

upper surface of the wing, along a band D lying at about the middle of the chord and running lengthwise of the wing, is formed with a series of perforations. These are preferably small, closely pitched holes, say, one sixty-fourth of an inch diameter and spaced one-quarter of an inch apart.

An inlet conduit E leads from the perforated strip to the chamber C, from which a conduit F leads to an outlet orifice in the lower surface of the wing near the trailing edge. From the tail pipe the exhaust gases discharge through a Mélot type multiple ejector-nozzle, or "thrust augmentor" G.

Together, nozzle G and chamber C constitute a fluid ejector which draws air through the perforated strip D, along the conduit E to the chamber and expels it rearwardly, together with the exhaust gases, through conduit F. The path from the perforations to the outlet is designed to give a smooth flow and diverges gradually to the chamber and then converges to the outlet. In this manner the kinetic energy of the air in the conduit E is converted to pressure energy. In chamber C the air is entrained by the exhaust gases and in flowing to the outlet the pressure energy is reconverted to kinetic energy and a forward thrust is obtained to assist the propulsion of the aircraft.

Fig. 6 shows an imaginative conception of a jet-propelled aircraft in which the boundary layer air flow is abstracted from the fuselage—it would also be taken likewise from the wings—and the efflux or jet is delivered on to the boundary layer region near the tail. In this type of design advantage is taken of both the Prandtl and Baumann proposals.

The most efficient forms of orifices for both the suction and pressure systems have been found to be similar to those shown respectively in Figs. 1a and 1b, where the suction orifice—air intake—is flush with the skin contour and at right angles to it, whilst the pressure orifice—jet—is arranged with its leading edge feathered to a sharp point profile in order to expel the air tangentially to the skin curvature.

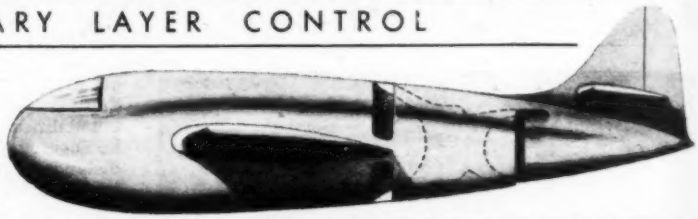


Fig. 6. The Prandtl and Baumann proposals for boundary layer control incorporated into a finely streamlined aircraft propelled by jet reaction. Velocities hitherto unattainable may become well within the bounds of possibility by the use of aircraft designed on these principles.

The finely streamlined shape of the fuselage made possible by the jet turbo-unit, added to the improved performance brought about by boundary layer control, should, it is estimated, result in a decrease in drag—other than induced—almost to zero, and it is not beyond the bounds of possibility that velocities approaching the ballistic might eventually be attained with aircraft designed on these principles.

No matter whether a single- or multi-engine design is in contemplation, the boundary layer air can be beneficially controlled in the manner described. A flying-wing design with multi-jet propulsion units would, on these counts, preferably have a series of air ducts arranged at the calculated stations behind the leading edge of the wing in order to abstract the boundary layer air into the compressors, and would likewise have jet orifices set in the aftermost portion of the chord.

If propellers were used in conjunction with turbines, they would most probably be of the pusher type—that is, true propellers—in order to gain whatever advantage was obtainable by deriving the engine intake air from the boundary layer region.

R.A.F. PHOTOGRAPHIC EXHIBITION

IN addition to a wide selection of photographs taken by the R.A.F. over enemy targets, the exhibition entitled "The Camera Has Wings" which was opened at Harrods, Ltd., Knightsbridge, last week by Lord Sherwood, Under-Secretary of State for Air, contains an interesting array of exhibits in the shape of R.A.F. photographic equipment, including the flash bomb used to record bombing as it actually takes place.

The photographs displayed—some of which have already been reproduced in the Press—include some really dramatic "shots" of enemy craft taking a beating from Fighter and Coastal Command, as well as those fascinating stereoscopic views of efficiently bombed targets of the kind chiefly used for damage assessment. Incidentally two attractive pictures of P.R.U. aircraft—Mosquito and Spitfire respectively—disclose by their captions that these high-speed high-altitude photographers fly unarmed and rely on sheer performance to keep out of trouble.

One notable photograph depicts a lifeboat being dropped to the crew of a "ditched" Fortress II in the North Sea; these lifeboats have been briefly mentioned previously, but the photograph shows they are supported by a triple parachute. Yet another interesting exhibit (from the purely decorative angle this time) is a stand with illuminated direct-colour photographs; these are of general interest rather than operational, and are beautifully done.

Among the several types of camera used in the R.A.F. is shown an example of the G.45 aircraft ciné camera, the mechanism and functioning of which is described and illustrated by Synchrophone. Other interesting "gen" is given by an attendant corporal who demonstrates the working of the Mark Ia night camera which is automatically operated by photo-electric cell, and the Universal night camera whose mechanism is set in motion by the release of the bombs and synchronised to the fuse-timing of the flash bomb.

Finally there is exhibited a captured sample of the *Luftwaffe's* standard reconnaissance camera. No doubt it is a most efficient optical instrument, but the visitor will be struck by the contrast between the compact British equipment used by the R.A.F., and the unwieldy dimensions of this 160 lb. camera, which somewhat resembles mother's electric washing machine.

The exhibition, which is to remain open for a month, is very conveniently arranged and well worth a visit.

NO POST-WAR AVIATION FOR AXIS

ALL aviation activities of any kind will be forbidden in Axis nations after the war, *American Aviation* recently stated in its daily news service. "According to the peace plans drawn up by United Nations leaders, no Axis country will be permitted to operate a national or international airline. Such air service as is necessary in those countries will be established by the United Nations, and the victors also will conduct all international traffic. The ban will apply as well to the building of aircraft and to civilian flying in Axis countries.

"It is also known definitely now that there will be no formal United Nations aviation policy conference until after the war—or at least until other post-war problems are ready for formal consideration. Meanwhile, informal aviation discussions between President Roosevelt and Prime Minister Churchill—which were begun at Quebec and continued at Cairo—will go on. Already the two have agreed to a permanent international air body after the war for the establishment of safety standards, communications and the handling of general traffic problems. The ticklish question of the use of airports built by Britain as well as by the United States also would come before this permanent group.

"The president, it is understood, favours a wide latitude of freedom of transit for aircraft of the United Nations, especially in the use of airports built for war purposes. He is also reported to oppose a monopoly for U.S. international air transport, feeling that the field is too large for one company to handle alone."

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

AIRCRAFT RECOGNITION

R.O.C. Master Test a Fiasco

JUDGING by correspondence in various papers and journals, the members of the R.O.C. are all unanimous in "taking a very poor view" of the master test. Although I passed myself, which can only be due to being able to remember having seen the photograph before, I think the test was a complete flop in its intention to be a master test in aircraft recognition, as a large proportion of the aircraft in the photographs were just dark shapes due to the weak lighting allowed.

Almost all the members of my post feel that the only way for the authorities to regain their confidence and enthusiasm is for them to apologise for the fiasco and start again.

"ONE OF THE TOO FEW."

WHAT'S IN A NAME ?

What the Dictionary Proves

I AM so much obliged to G.R.Ae.S. (in a recent issue) and his dictionary for proving that the word "raid" is wrong, though G.R.Ae.S. has failed to notice the fact. Certainly attacks by aircraft (and guns) are "military expeditions," but a "predatory incursion" is not a bomber's job as "predatory" means plundering or pillaging.

Then again, the emphasis in "surprise" hardly applies to bombing—at least, I cannot imagine Germans any longer surprised at being bombarded from the air; their state of mind must be expectant.

I also hope that when G.R.Ae.S. suggests the word raid indicates "short duration" of attack he will give up using it. What we hope for is the long duration of attack better suggested by the longer word "bombardment."

This reply is in all humility to G.R.Ae.S., who must have a superior status to F.R.Ae.S.

BROADCAST ELECTRIC POWER

Imaginings Become Proven Facts

RADIO power vibrates certain matter and the subsequent complimentary is detectable and reproduced. The power used seems to have no relation to the continuity of the vibration. In 1928, using short waves, the writer had communication with Siberia with an unbeamed vibration, set up with 0.012 watts, attributed then to heavyside layer effect.

An electron microscope, with electromagnetic lens, employs an anode voltage of 55 to 60 kV. The higher frequencies or "oscillatory atomic vibrations" and relative power are barely understood as yet.

Engine and fuel power are only relative to resistance and gravitation. Fluorescent acceptance of rays is possible and it does not, with imagination and speculation, appear impossible that energy akin to "radio waves" will dispense with engine and fuel power as such.

Mr. J. T. Kendall (Metropolitan-Vickers Electrical Co. Research Dept., per *Electrical Review*, February 18th, 1944) declares Prof. Felix Ehrenhaft's claim of "pure magnetic current" as "not proven," ascribing the phenomena as due to more generally accepted causes.

As a regular reader since the first issue of *Flight* I have seen many "imaginings" become "proven fact," and the present wasteful application of *existing* force, via engine and fuel, will eventually find its remedy in oscillatory vibrations akin to radio waves.

EDWARD S. ELLIOTT, M.R.S.G.B., M.J.Inst.E.

Two Outstanding Snags

AS an electronic engineer, I hesitate to enter the transmitted power controversy which breaks out periodically, but some of the statements in Mr. Wright's letter (*Flight*, February 17th) are so fallacious that they call for some correction. He cannot have subscribed to the *Wireless World* for very long.

Of course, the signal from a wireless station can operate a mechanical device without amplification; any crystal set is an obvious example. Some years ago an ingenious German engineer was prosecuted for lighting his house from the neighbouring Cologne transmitter, and since he had paid his licence fee special legislation was called for to stop the practice. Mr. Wright's point about amplifiers is totally irrelevant; they derive their power from a self-contained supply or from the mains, not from the ether. The total wireless station power in this country very greatly exceeds 5,000 kilowatts.

The difficulties in the way of broadcast power transmission are many, but two stand out above all others. No one has yet been able to produce a beam so sharply defined that most of the energy is concentrated on the aircraft when it is at a considerable distance from the transmitter; if such a beam could be produced it might fairly easily be made to follow the aircraft automatically. Secondly, the apparatus necessary to transform heavy power, necessarily at high frequency, into a form suitable for driving a motor is so bulky and expensive that it would outweigh the conventional prime mover.

It is not easy to see what advantages would accrue if efficient radiated power transmission were possible, except in the case of very long-distance flights. Since the power/weight ratio of an electric motor is so low compared with a modern aircraft engine, it is only when a great weight of fuel is carried that the effect is counter-balanced.

GERALD I. HITCHCOX,
(Chief Designer for R. K. Dundas, Ltd.).

JET PROPULSION OF AIRCRAFT

The Froude Actuator Disc Theory

YOUR correspondent A. L. Ward (*Flight*, Feb. 17th) wishes to learn whether it would be practicable to employ jet propulsion for a 35,000-ton battleship.

Approximately, the Froude Actuator Disc theory applies both to J.P. and to underwater screw propulsion (vide Feb. 10th issue). Thus

Thrust in air $= \rho_a S_a V^2(1 + a_1) \cdot 2a_1$

Thrust in water $= \rho_w S_w V^2(1 + a_2) \cdot 2a_2$

where the suffixes "$_a$" and "$_w$" denote the densities, actuator areas and inflow factors of air and water respectively.

But Drag $= kV^2$.

Equating thrust to drag :—

$$kV^2 = \rho_a S_a V^2(1 + a_1) \cdot 2a_1$$
$$kV^2 = \rho_w S_w V^2(1 + a_2) \cdot 2a_2.$$

Solving the quadratics for a_1 and a_2,

$$a_1 = \tfrac{1}{2}\left(\sqrt{1 + \frac{2k}{\rho_a S_a}} - 1\right)$$

$$a_2 = \tfrac{1}{2}\left(\sqrt{1 + \frac{2k}{\rho_w S_w}} - 1\right)$$

$\therefore$ Efficiency of air propulsion $= \dfrac{1}{1 + a_1} = 2/1 + \sqrt{1 + \dfrac{2k}{\rho_a S_a}}$

Efficiency of water propulsion $= \dfrac{1}{1 + a_2} = 2/1 + \sqrt{1 + \dfrac{2k}{\rho_w S_w}}$

From these equations it can easily be seen that, for the two ideal efficiencies to be equal, the diameter of the J.P. actuator disc must be something like 40 times that of the corresponding underwater drive.

Even making allowances for the admittedly sweeping simplifications involved, and for any mechanical advantages of J.P., it is obvious that the loss of efficiency effectively prevents its practical adoption. Whether J.P. could be so modified as to employ an underwater drive, however, remains a question perhaps meriting attention.

S. A. BOWHILL.

Calculating Jet Efficiency

MOST of the points "Projet" (*Flight*, Feb. 24th) raises in criticism of my letter could be more readily settled by reference to a textbook on elementary physics.

However, when one wishes to prove something, it is first necessary to know what is to be proved. When I attempt to calculate the jet efficiency, in terms of slip and airspeed, for a jet machine in steady motion, and prove this analogous to airscrew efficiency, I do not expect criticism on the grounds that it does not agree with the formula for a rocket in vacuo.

A rocket carries its own propellant, whereas a jet machine

CORRESPONDENCE

uses the surrounding air. A rocket in vacuo needs no power to keep going at a steady speed, whereas a jet machine is still going to have air resistance to cope with.

The thrust and instantaneous efficiency (i.e., at a particular speed) can be calculated as for a jet machine giving:—for a rocket aircraft,

Thrust (leaving out g for "Projet's" benefit)
= M × Discharge Velocity (*in Poundals*)

Efficiency $= \frac{2}{2+r}$ where $r = \frac{\text{Discharge Velocity}}{\text{Aircraft Speed}}$

Note that Discharge Velocity takes the place of Slip Velocity in my previous letter. So that, in "Projet's" machine-gun analogy, bullets can be going in the same direction as the gun, but still be giving thrust; which is dependent only on Discharge (Muzzle) Velocity and mass of bullets per second.

I cannot see any objection to relating velocities and efficiencies to the ground, or rather to still air. If we were not concerned with getting around the earth, there would be no aircraft, and no *Flight*, hence no letter from "Projet."

As for a more comprehensive efficiency formula, thermal efficiency would appear to depend on compression ratio and on heat losses through the walls, as in an internal combustion engine. Also, compressor and turbine efficiencies would have to be taken into account

J. K. HAVILAND.

Propulsion in a Vacuum

IN *Flight* for February 17th, "AJAR" appears to have misunderstood my letter stating that there is no need for propulsion in a vacuum once the desired velocity has been attained. This is not a theory, but a fact, and if the object is an aircraft no lift can be expected from the wings in the vacuum, so that the force of gravity would have to be opposed by the vertical jets which I have already suggested.

"PROJET."

THE WORLD'S BEST AIRCRAFT

Only Contemporaries Should be Compared

IN Mr. Masefield's article he seems to have overlooked the fact that the Germans have some very fine aircraft, two of which immediately come to mind—the Ju 88 and the Fw 190. When they came out they were the best. Also he seems to be comparing the most modern American types with British machines that have been in service for two or three years.

Compare British and American machines of the same periods, please! Another thing—what has happened to the Avro York? To my mind it is better than any other transport in the world. To state that the Mustang is better than the Typhoon makes one think that he doesn't know what he is talking about. By what process of reasoning does he arrive at the conclusion that the "Lib." is better than the Lancaster? Anyone who knows anything about these machines at all can see that he is hopelessly mistaken. A point to remember is that Britain was the first country to produce fighter aircraft flying at more than 300 m.p.h. operationally.

TATTON WINTERJOHN.

Types Apparently Forgotten

MR. MASEFIELD'S article on the best aircraft in the world intrigues me. I openly admit that I completely fail to see the idea of Mr. Masefield's point system, so it must be borne in mind that I am not basing any of my opinions on the point system.

How Mr. Masefield, a man of undoubted authority in the aviation world, can say that the Lockheed Lightning is the best single-seat fighter-bomber in the world is, to me at any rate, astonishing. I am pretty certain that there will be a lot more air enthusiasts amazed at this statement. Has Mr. Masefield by any chance forgotten the Hurribomber, the M 210 or the later marks of Ju 88? My plea is that for a high-efficiency fighter-bomber the designer does not stick to single-seaters or converted fighters, but that he develops a machine specially for the job. Now, is the Lightning specially built for this? Certainly not. The original purpose for it was escort fighter. The Typhoon, if we must be conventional and go on the "single-seater" lines, is as fast as the Lightning and pretty well equal in fire power. Also, it gets from one engine what the Lightning strives for on two. Are we therefore to swallow Mr. Masefield's almost unfounded remarks on this point?

And what of his best land-based torpedo bomber? I should say that, due to its fuselage design and general features, such as crew positions, manœuvrability and range, the Hampden is pretty high up on the list, and definitely not the Beaufighter. The "hanging on" of the torpedo on a Beau. is most unprofessional, and in any case the Beaufighter is primarily a ground strafer and long-range fighter, in which capacities it has performed supremely well. The naval torpedo bomber is undoubtedly the Avenger. It is interesting to note a "bit of Hampden" about the Avenger, incidentally. We will draw a veil over naval dive bombers!

I always understood that the Commando was a long-range transport, but according to Mr. Masefield it is a medium-range job. I heartily endorse his choice of the Skymaster.

That such "old faithfuls" as the Barracuda, Albacore, and Swordfish should be mentioned, even in the "some types considered" column, is amazing. No doubt Mr. Masefield imagines some pretty battle scene in which one or all of these primæval manifestations competes with such machines as the Avenger.

And have we enough evidence of the Mitchell's worth to quote it as the best of all twin-engined attack bombers? (and tank busters?). No doubt it would "bust" a tank if it hit it with its 75 mm. gun, or sink ships with the same weapon; but are we to forget the far more practical arrangement of four 20 mm. cannon on the Mosquito, or the experiments actually being made with 40 mm. cannon on the Hurricane?

In the future we can with some margin of safety stray from the orthodox, but not in wartime, please! Exit Lightning, Barracuda, Whirlwind, etc.

I make no attempt to put forward any one aircraft as the best in the world. All I ask is that we indulge in a little retrospection when attempting to classify aircraft.

R. FANO.

Support for Masefield's Selection

I READ the article by Peter Masefield on "The World's Best Aircraft" with much interest. I should like to take up the cudgels on the author's behalf. I suppose, in his present job he will not be able to reply himself, or we might see the sparks fly.

Surely Mr. Masefield's formula does attempt to achieve an unbiased result. Some of the criticisms of the article do not seem entirely free from bias; perhaps because British aircraft do not predominate, although I see they form some of the more important categories.

The comments that the comparisons are in some cases between older British aircraft and newer American types do not hold water. I have been through the list carefully, and, so far as I can see, all the aircraft compared are the latest announced in service of each individual type. Messrs. Lloyd and Lickley differ from Mr. Masefield in the fighter category. They suggest the Typhoon IB is superior to the Merlin-Mustang as a medium-altitude fighter and the Spitfire IX as a high-altitude fighter. But I understand that the Merlin-Mustang is somewhat faster than both the Typhoon IB and Spitfire IX at medium and high altitudes; it certainly has a much longer range, as its recent escort missions prove, and I learn on good authority that in maintenance and man-hours of production the Mustang shows up at least as well as any fighter in service. So there seems to me good evidence from Messrs. Lloyd and Lickley's "only infallible yardstick," of "results achieved in operations," for putting the Mustang at the top in both categories.

Obviously the heavy bombers must be divided into day and night categories, because the lightly armed night bomber will not do well by day and the lighter bomb load of the day bomber will be less effective at night. So I think few will quarrel with Mr. Masefield when he puts the Lancaster "top" at night. By day, I suppose the latest Liberator might be assessed higher than the Fortress. The Americans have announced in their own reports that the Liberator B-24J has been in action for some time armed with 14 half-inch guns, ten of them in power-operated turrets, compared with 12 guns (six in power-operated turrets) of the Fortress B-17G. Besides this, the newest Liberator carries a bigger load slightly faster and farther than the Fortress. By day the Lancaster cannot make the grade on cruising, ceiling or armament.

Mr. Bray does not seem to have read the article in detail, so he has not appreciated that the "major factors" of range and defence for day bombers (without which they surely would not reach the target) are backed up with "subsidiary factors" which include bomb load, and so on. It seems to me that Mr. Masefield's major and subsidiary factors are all interconnected and do give the fairest comparisons yet achieved on all counts. And applying the yardstick, of results achieved in operation, the selections do not seem much to quarrel with.

CHARLES V. WILLIAMS.

The Air Estimates

Sir Archibald Sinclair's Great Speech : Revival of A.D.G.B. : Air Supremacy Clearly Attainable

INTRODUCING the Air Estimates in the House of Commons on February 29th, Sir Archibald Sinclair, Secretary of State for Air, said that Parliament had staked heavily on the Royal Air Force during this war, and of the resources allotted the largest share had been given to Bomber Command.

Before dealing with this Command, he reviewed other aspects of the contribution made by the air to the common effort. He paid tribute to the individuals, squadrons and forces of Dominions, Colonies and Allies which were working with the R.A.F., and then turned to the position of Great Britain as the great air base. It had not been a pleasant thing, he said, for our people to have their land turned into an air base, and he was glad to say that the Air Ministry had almost reached the end of their territorial demands. They had only been able to fit so many air stations into this small island because much of our training had been carried on in the Dominions and the United States. Sir Archibald dwelt on our shortage of airfields, training aircraft, and, most important of all, experienced instructors when our training expansion began, with an inevitable high rate of accidents, but he said that in the last two years the accident rate for the whole R.A.F. at home (and most remarkably the rate in night flying) had fallen steadily, and now was lower than at any time during the war. "In the Air Ministry all were training-conscious; some might say training-mad." Sickness had also been reduced, and strides had been made in the rehabilitation of men suffering from burns, wounds and accidents.

Transport Command

Sir Archibald then turned to the work of Transport Command, mentioning, among other things, the way it had fed and supported the 7th Indian Division in Burma during the great victory in Arakan. The burden of air transport was shared with this Command by the British Overseas Airways Corporation, to which he paid a tribute, and remarked that the increase in its route mileage "did not look like putting civil aviation into cold storage."

The Battle of the Atlantic was next dealt with. The war against the submarine, said Sir Archibald, was a war of wits. Admiral Doenitz was reported to have said that an aircraft could no more attack a submarine than a crow could attack a mole. "The mole was trying to turn himself into a porcupine, but he still could not escape Coastal Command's talons." This Command had also had a year of extended activity and considerable success against surface shipping. It had been giving particular attention to Germany's coastal traffic from the iron mines of Norway to the Rhine ports, and, helped by the sea-mining of Bomber Command, had sunk quite a proportion of it.

Meanwhile, said the Air Minister, our forces in the Far East had been built up, and the Japanese had lost the air superiority they enjoyed in 1942. A notable event of the year had been the arrival of Spitfires in that theatre.

Sir Archibald then briefly recapitulated recent events in the Mediterranean, stressing the recent bad weather in Italy, where, as the pilots put it, "the clouds were stuffed with mountains." He added: "We must not expect the impossible of them (the airmen); the Army did not." Sir Archibald then quoted remarks of General Arnold, Commanding General of the U.S. Army Air Forces, on German tactical mistakes in the recent campaigns. By contrast, said the American General, "the Royal Air Force, employed in concentrated mass, as a true Air Force should be, completely destroyed some 1,100 Italian planes." The Mediterranean campaign, went on the Secretary of State, had been the chief testing ground for our methods of combining air and surface forces in one great instrument of war. "It did not matter," he said, "whether this instrument was commanded by a soldier or an airman; what mattered was that the Air Forces should be commanded by an airman and the troops by a soldier, each working to a common plan."

Reviving A.D.G.B.

The situation at home next claimed the attention of the Air Minister, both as regards plans for the liberation of Europe and also the defence of the country. The following is a report of this passage of the speech:—

In this country the Royal Air Force was preparing to play its part, in combination with the Army and the Royal Navy, in the battle for liberating Europe. We had made our dispositions. A year ago we had Fighter Command and Army Co-operation Command. The latter was designed solely for working with the Army. Fighter Command not only defended this country and escorted coastal convoys but also carried out offensive operations across the Channel. These two Commands had now been combined with the American 9th Air Force into a new organisation described as the Allied Expeditionary Air Force, under the command of Air Chief Marshal Leigh-Mallory. This force had two main components. On the one hand, the 2nd British Tactical Air Force, under the command of Air Marshal Coningham, and the 9th American Air Force, under General Brereton, would be available to support operations on the Continent of Europe; on the other hand, a force for which we had revived the old title of the Air Defence of Great Britain, under the command of Air Marshal Hill, would be responsible for the day and night defence of these islands. We had thus separated and defined the offensive and defensive functions, while at the same time unifying them at the highest level for the great and intricate battles ahead. These squadrons, both in the Allied Expeditionary Air Force and in the A.D.G.B., were actively engaged in training as well as in operations. They were not standing idly by waiting on events, but they were constantly attacking objectives in France and the Low Countries, or ships at sea or in harbour, escorting bombers in their attacks on occupied territory, and also giving escort to American bombers on their way out or on their way home from battles over Germany.

The Bomber Offensive

Then the Air Minister arrived at what was the main feature of his speech, namely, the bomber offensive. The battle which Bomber Command and the United States Army Air Forces were fighting over Germany was, said Sir Archibald, on so different a scale that it was impossible to compare it with the German blitz on this country. Huge centres of war industry in the Ruhr, in Hamburg, in Berlin, and many other German cities had been obliterated, and, in the past year, the United States Army Air Force had entered the battle in full strength. A recent spell of weather of a kind which favoured daylight precision bombing also enabled the British and American Bomber Commands to combine both day and night operations and operations from Italian bases with those from British bases. They were swift to seize this opportunity, and to act upon plans prepared for many months past. It might well be that historians of the future would look back upon this period between the February and the March moons as one of the decisive stages of the whole war.

To assess whether the results we had gained justified the resources we had spent on our bomber force was not a

THE AIR ESTIMATES

matter of speculation. He had the impression that our bomber offensive was sometimes thought of as if it were producing no visible results for the time being, but might lead suddenly to the enemy's collapse, as if we were hammering at a door in the expectation that the lock might suddenly give way. On the contrary, we were steadily pushing the door open, inch by inch, until we could pass through. Our offensive was producing results which were visible, measurable, and progressive. As soon as possible after our attacks we always photographed the results. We knew not merely what factory had been hit but which shop in the factory and what it was producing.

Assessable Damage

The concentrated products of thousands of hours of skilled work, of careful rationing, spoils from the occupied territories, supplies laboriously transported thousands of miles, the precious fraction that got through our blockade, were all destroyed in one night. Machine tools, generators and transformers, precision instruments, all were buried under a crumpled heap of girders; food, materials, chemicals, and timber were piled in a smoking ruin. These were the sinews of war. Repair and replace them the Germans could in the long run, if we let them—some of their efforts at repair had been really remarkable. But it was in these photographs of bomb damage that we could read some at least of the reasons why Germany had no longer abundant man-power and materials to throw into the offensive; repair and defence must have first claim. Far better than capturing or destroying 100 enemy guns in the field, after, perhaps, they had killed many of our men, was to destroy them half completed in the shops, and at the same time the tools with which the enemy could in a month produce 200 more.

Berlin was the greatest battle of all. Little output could have been obtained from its hundreds of factories or those that were still functioning at all. With little efficiency could the administrative centre of the Reich have been directing their vast war machine, when the people knew that the morning might see no trains or trams or buses running, no electricity, no gas, no water, and when the shops were empty, their meals obtained from canteens, and their nights spent in a shelter, and their prospects—still greater desolation. We should be wearing long faces now if we had lost one quarter of the resources the Germans had lost in the last year. It was not only the overall loss of production and consumption of man-power on repair and replacements; there were many points where the Axis was especially vulnerable, and these had not been neglected. Some of them had been particularly appropriate—since the specialised targets were usually small—for attack by day, and it was against such targets, heavily defended because so vital to the enemy, that some of the most successful blows of the American Army Air Forces had been delivered.

The offensive justified itself by the fact alone that we were keeping from the Eastern and Mediterranean fronts aircraft, men, and guns that might have turned the battles there. Bomber Command and the United States bomber squadrons had compelled the German High Command, as their whole front recoiled in the East, to tie down for the protection of their factories full four-fifths of their fighter strength in the West. This was the true strategic employment of air power. Our gains had not been won without losses. From bombing operations from this country in the last year over 2,500 aircraft had not come back. Taking an average of seven men per aircraft, this meant that nearly 18,000 men, drawn from the flower of our manhood, were killed or prisoners. But that should be compared with the bloody fighting of the Eastern front, or with the carnage of the last war. In one day, July 1, 1916, we lost on the Somme 21,997 men killed and missing, to secure, in the words of the Official History, an advance 3½ miles wide and one mile in depth. Our aircrews who had fallen in destroying the weapons of the Nazis at their source were in the position of the man who died putting out of action the enfilading machine-gun which was decimating his comrades and so let the advance go through.

The Air Minister then mentioned our decreasing rate of casualties and the development of navigational aids and safety devices. He paid a tribute to the combined work of British and American scientists, to the Pathfinder Force, and to Sir Charles Portal and other high officers. He ended by saying that the events of the coming weeks no man could foretell. Already, while the dust and smoke still billowed around his shattered factories, the enemy was driving his toiling millions in desperate efforts to recover the ground he had lost. The wounded tiger was dangerous. But there lay before us, now clearly attainable, the glittering prize of air supremacy, the talisman that could paralyse German war industry and war transport. That would clear the road for the progress of the allied armies to Berlin.

A debate then followed.

CIVIL AVIATION

IT is only possible, in the limited space at our disposal, to give a very brief outline of the debate on Civil Aviation, opened by Mr. Bowles, the Labour Member for Nuneaton, the full report of which filled no less than 63½ columns in *Hansard*. In effect the debate boiled down to Labour *versus* the Rest, and it was enlivened now and then by some of those traditional Parliamentary exchanges which are more entertaining than constructive.

Mr. Bowles, supported by Mr. M. Hughes (Carmarthen) and Mr. A. Bevan (Ebbw Vale), moved as an Amendment that "This House, realising the important part that civil aviation can play in bringing the peoples of the world together and in promoting mutual understanding, urges that post-war plans shall not regard national facilities for this means of air transport as a bargaining point between the nations, but be based upon the need for full international co-operation."

On the matter of post-war air traffic, Mr. Bowles was not very optimistic. "I find," he said, "that people are exaggerating tremendously the real importance of civil aviation after the war. So long as air travel remains so very dear, it is obvious it can attract only the real cream of the rail, road and shipping traffic. The first-class passengers of liners will be the only people who will be able to afford air transport." From available information he thought that about fifty aircraft would be all that would be needed after the war to carry "that cream of traffic which is likely to travel by air."

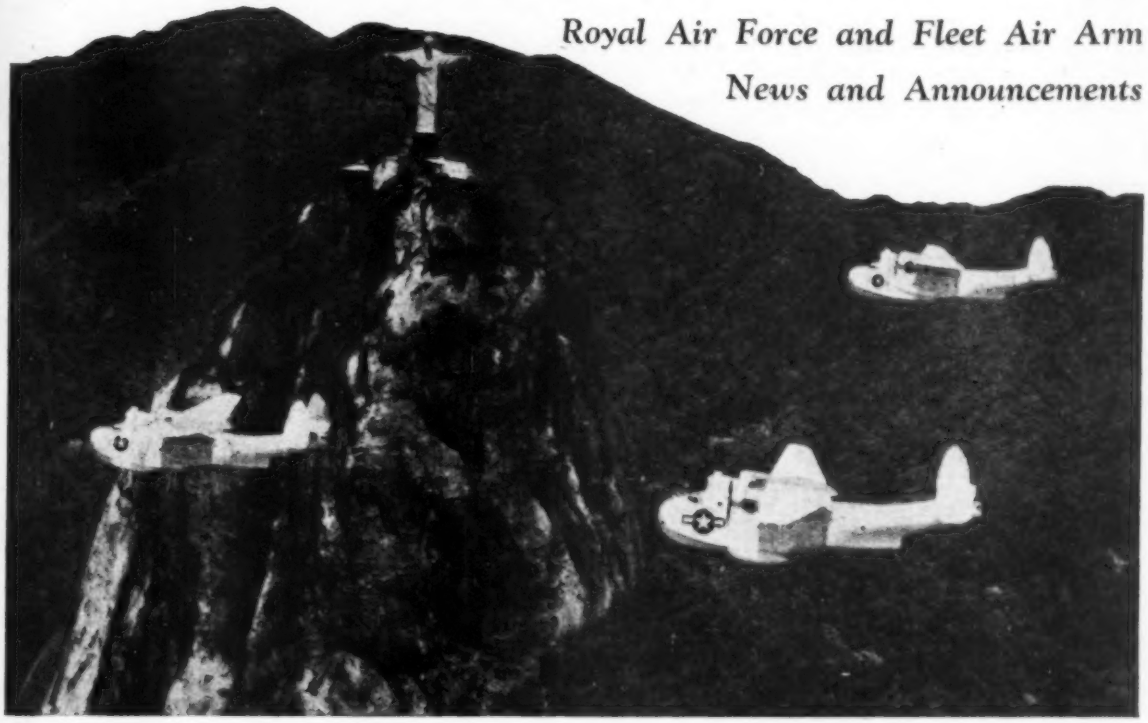
Finally, Mr. Bowles spoke in favour of the complete internationalisation of civil aviation, as the Labour Party's solution to the main problem. They believed it was the only scheme to save the peace of the world. Mr. Hughes, seconding the amendment, intimated that those who were mainly concerned with seeing that the British Empire "got its place in the air" were using arguments that were inspired by an urge for power and prestige, and thus led eventually to war. Still less would it lead to peace if civil aviation were kept under the control of the Air Ministry, for to have civil and military aviation linked under the same roof could not fail to breed suspicion and distrust; it would also prevent the growth of a really civil type of aircraft. Nine-tenths of those engaged on producing aircraft to-day would not be wanted as far as civil aircraft were concerned.

Among those who spoke against the amendment were Group Capt. Wright, who said internationalisation was impossible so long as America and Russia held their present views; Lt. Col. Sir Thomas Moore, who said one could only feel that Messrs. Bowles and Hughes were living in a world of fantasy; Flt. Lt. Teeling, who said that if it was the Labour Party's policy so pessimistically to decry the future of the air, they would never get young men and women to join them; Mr. Quintin Hogg, who used such terms as silly, cowardly, defeatist and ignorant in referring to the Labour policy, and said their scheme was "bogus from its inception," and finally Capt. Harold Balfour, who replied at some length for the Government, after saying that when he listened to the Labour speeches, he began to wonder if it was really necessary to have the debate at all.

Mr. Hogg's speech was followed by a counter-blast from Mr. A. Bevan, who said the Hon. Member for Oxford's contribution to the debate was derived from his hatred of the Labour Party.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm
News and Announcements



Mariner patrol-bombers fly past the *Christos Redemptor* statue which stands on a peak near Rio de Janeiro.

Appointments

AIR VICE-MARSHAL R. D. OXLAND, C.B., C.B.E., now fills a special appointment in Bomber Command. He has been senior Air Staff Officer at Headquarters Bomber Command since February, 1943. Previously he was commanding a bomber group.

Air Vice-Marshal H. S. P. WALMSLEY, C.B.E., M.C., D.F.C., who has been Air Officer commanding a bomber group for two years and had served previously at Headquarters Bomber Command on air staff training duties, is now Senior Air Staff Officer Bomber Command. When the present war began he was given command of a R.A.F. wing in France and since 1939 has been four times mentioned in despatches.

Air Comdre. J. A. GRAY, C.B.E., D.F.C., G.M., is to be Air Officer commanding a group in Bomber Command and to be Acting Air Vice-Marshal. Air Vice-Marshal Gray has been in command of a base since December, having for about eight months before been Deputy Senior Air Staff Officer at Bomber Command Headquarters.

Awards

THE KING has been graciously pleased to approve the following awards in recognition of gallantry and devotion to duty in the execution of air operations:—

Bar to Distinguished Service Order

Act. Sqn. Ldr. J. SALE, D.S.O., R.C.A.F., No. 35 Sqn.—One night in December, 1943, this officer was the pilot of an aircraft detailed to attack a target in Germany. Although heavy cloud prevailed over the target, Sqn. Ldr. Sale displayed great persistence and made five runs over the area before releasing his bombs. The return flight was safely accomplished, but, whilst over base at a height of 1,500 feet, some stores exploded and flames burst out near the rear turret and the underside of one of the wings. The aircraft quickly became filled with smoke and fumes and the fire spread rapidly. The danger of the tanks exploding was soon apparent. Coolly, Sqn. Ldr. Sale turned away from the airfield, regained height and ordered his crew to leave by parachute. By this time, he could hardly see the instruments as the smoke in the cockpit was so dense. As he was just about to leave the aircraft himself, Sqn. Ldr. Sale saw, standing beside him, a member of the crew who had been unable to leave as his parachute was badly damaged and unusable. Sqn. Ldr. Sale therefore decided to attempt to land the burning aircraft, and succeeded in so doing. The floor of the fuselage, some equipment and some stores were blazing as he and his comrade got clear. When they were a bare 200 yards away the aircraft exploded. In circumstances of great danger, Sqn. Ldr. Sale displayed great courage and determination, setting an example of the highest order.

Distinguished Service Order

Act. Sqn. Ldr. J. R. H. MERIFIELD, D.F.C., R.A.F.V.R., No. 540 Sqn.—This officer has proved himself an exceptionally able photographic reconnaissance pilot. He has taken part in many long range flights. In addition he has also undertaken several successful night photographic sorties. Sqn. Ldr. Merifield has been a most distinguished flight commander. He has completed much valuable experimental work.

P/O. Andrew Maitland, No. 76 Squadron, who has been awarded the D.F.C.

Bar to Distinguished Flying Cross

Act. Sqn. Ldr. A. J. DOWLING, D.F.C., R.A.F.V.R., No. 35 Sqn.—Sqn. Ldr. Dowling has continued to render fine service to his squadron since the award of the D.F.C. His accuracy and reliability as a navigator have led to the successful completion of many sorties. He has always displayed outstanding keenness and enthusiasm for operations and has contributed much to the success attained by the Squadron.

Act. Sqn. Ldr. J. F. C. GALLAHER, D.F.C., R.A.F.V.R., No. 105 Sqn.—Throughout a very large number of operational missions, Sqn. Ldr. Gallaher has shown a high standard of reliability and skill. He is a remarkably cool and able navigator, who has always attained great success in his operational tasks. Sqn. Ldr. Gallaher has always accomplished his tasks with the utmost courage and tenacity.

Act. Sqn. Ldr. M. D. S. HOOD, D.F.C., R.A.F.O.—This officer received the D.F.C. in May, 1941, and up to the time of recommendation had completed a large number of operational sorties involving many hours flying. During his second operational tour he carried out consumption and range tests in photographic reconnaissance aircraft, from which much valuable information was obtained. Sqn. Ldr. Hood has shown determination, skill and method in all his work and has proved an excellent leader, showing a fine example to other members of his flight. He completed his second operational tour in July, 1943, and is now a member of a training unit.

Act. Sqn. Ldr. G. L. MANDENO, D.F.C., R.A.F.V.R., No. 156 Sqn.—Sqn. Ldr. Mandeno has completed a very large number of operational sorties. Since the award of the D.F.C. he has participated in attacks on Hanover, Modane and Leipzig. Five of his recent sorties have been attacks on Berlin, where he achieved most satisfactory results in a responsible role.

Distinguished Flying Cross

F/O. C. E. M. AGG, R.A.A.F., No. 460 (R.A.A.F.) Sqn.
F/O. H. C. C. BANKS, R.C.A.F., No. 405 (R.C.A.F.) Sqn.
F/O. W. B. B. CLOUTIER, R.C.A.F., No. 405 (R.C.A.F.) Sqn.

SERVICE AVIATION

F/O. B. A. CRADDOCK, R.C.A.F., No. 405 (R.C.A.F.) Sqn.
F/O. G. R. DRIMMIE, R.C.A.F., No. 405 (R.C.A.F.) Sqn.
F/O. R. MASON, R.A.A.F., No. 460 (R.A.A.F.) Sqn.
F/O. H. W. KEANE, D.F.M., R.C.A.F., No. 619 Sqn.
F/O. C. MASSEY, R.C.A.F., No. 426 (R.C.A.F.) Sqn.
F/O. L. T. PRITCHARD, R.C.A.F., No. 56 Sqn.
F/O. N. S. ROSE, R.A.A.F., No. 405 (R.A.A.F.) Sqn.
F/O. D. H. SIMPSON, R.C.A.F., No. 50 Sqn.
F/O. E. F. WHEELER, R.C.A.F., No. 199 Sqn.
F/O. F. H. WITTMER, R.A.A.F., No. 49 Sqn.
P/O. K. O. BARNES, R.A.A.F., No. 49 Sqn.
P/O. L. G. BERRY, R.A.F.V.R., No. 106 Sqn.
P/O. J. L. BOULTER, R.A.F.V.R., No. 51 Sqn.
P/O. R. J. BREWER, R.A.F.V.R., No. 12 Sqn.
P/O. J. F. C. BROWN, R.C.A.F., No. 50 Sqn.
P/O. D. S. CAMPBELL, R.A.F.V.R., No. 101 Sqn.
P/O. J. V. CLARK, R.A.F., No. 51 Sqn.
P/O. L. G. COBURN, R.C.A.F., No. 450 (R.C.A.F.) Sqn.
P/O. L. A. COXILL, R.A.F.V.R., No. 49 Sqn.
P/O. G. A. B. CRAIG, R.A.F.V.R., No. 76 Sqn.
P/O. S. N. CUNNINGTON, R.A.F.V.R., No. 625 Sqn.
P/O. J. A. L. CURRIE, R.A.F.V.R., No. 626 Sqn.
P/O. A. M. DAVIDSON, R.C.A.F., No. 51 Sqn.
P/O. L. A. DEVERIDGE, R.A.A.F., No. 460 (R.A.A.F.) Sqn.
P/O. G. P. GEORGE, R.A.A.F., No. 49 Sqn.
P/O. A. H. GIBSON, R.A.F.V.R., No. 630 Sqn.
P/O. A. GOLDSTRAW, R.A.F.V.R., No. 51 Sqn.
P/O. R. HALPERIN, R.A.F.V.R., No. 101 Sqn.
P/O. D. HARRIS, R.A.F.V.R., No. 35 Sqn.
P/O. J. C. HARRIS-WARD, R.A.F.V.R., No. 51 Sqn.
P/O. A. S. J. HOLDER, R.A.F.V.R., No. 51 Sqn.
P/O. L. C. HOWELL, R.A.F.V.R., No. 100 Sqn.
P/O. K. H. ISAAC, R.A.F.V.R., No. 51 Sqn.
P/O. P. F. JARVIS, R.A.F.V.R., No. 35 Sqn.
P/O. F. E. JOHNSTON, R.C.A.F., No. 35 Sqn.
P/O. C. R. KROEMER, R.A.A.F., No. 625 Sqn.
P/O. F. H. TRITTON, R.A.F.V.R., No. 100 Sqn.
P/O. J. B. WARWICK, R.A.F.V.R., No. 49 Sqn.

Conspicuous Gallantry Medal

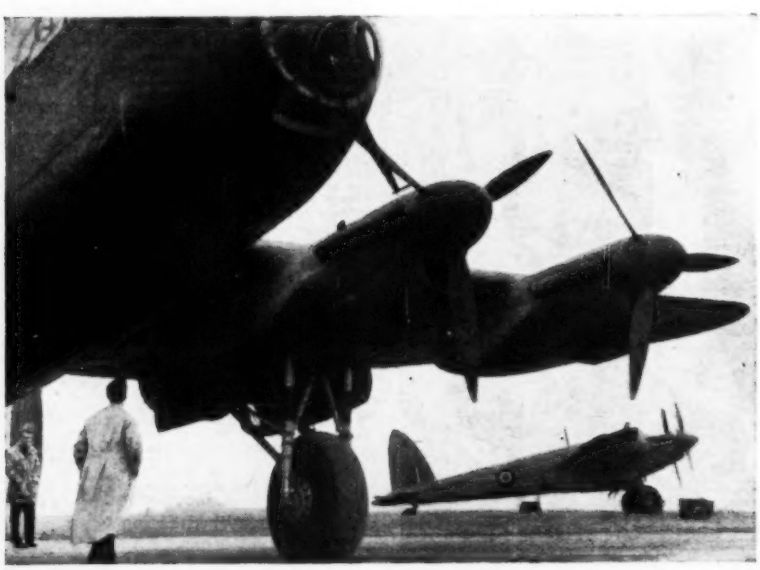
W/O. R. C. MEEK, R.C.A.F., No. 626 Sqn.—F/O. Breckenridge, P/O. Baker and W/O. Meek were pilot, mid-upper gunner and navigator respectively of an aircraft detailed to attack Berlin one night in January, 1944. Whilst over the target area the aircraft was hit by bullets from a fighter. Much damage was sustained. The wireless operator was killed and the rear gunner was wounded; P/O. Baker was also wounded, being hit in the face and rendered unconscious. Nevertheless, F/O. Breckenridge evaded the attacker and, displaying great determination, resumed his bombing run and successfully attacked the target. Almost immediately the bomber was again hit by machine gun fire from the enemy aircraft which had closed in. This time W/O. Meek was severely wounded. A bullet penetrated his breast close to the heart and another one hit him in the shoulder. Coolly and skilfully, F/O. Breckenridge manœuvred his badly damaged aircraft, however, and finally evaded the attacker. By now, P/O. Baker had recovered consciousness and, realising that the aircraft was unprotected, immediately made his way to the rear turret and manned it. In spite of his physical suffering, the intense cold and the lack of oxygen, P/O. Baker remained in the turret throughout the homeward flight, except for a short time when he left it to extinguish a fire which had commenced. Meanwhile, W/O. Meek, though desperately wounded and suffering intensely, refused to leave his post. Although deprived of practically all his navigational equipment he plotted the route home with great skill. Eventually, F/O. Breckenridge reached base, where he effected a successful crash-landing. His skill, courage and coolness in the face of heavy odds were worthy of the highest praise. P/O. Baker and W/O. Meek proved themselves to be valiant members of aircraft crew, displaying great courage, fortitude and devotion to duty. In spite of their injuries and much suffering they did all that was possible to assist in the safe return of the aircraft.

Bar to Distinguished Flying Medal

Sgt. G. S. ALMOND, D.F.M., R.A.F., No. 158 Sqn.—Throughout his tour of duty, Sgt. Almond's work has been of a very high standard. On a number of occasions he has effected repairs to his wireless apparatus, thus making possible the success of the sortie. When engaged by the enemy his coolness, skill and courage have been of the highest order.

Distinguished Flying Medal

Sgt. A. E. KEELING, R.A.F.V.R., No. 49 Sqn.
Flt. Sgt. G. M. BURCHER, R.A.A.F., No. 10 Sqn.
Flt. Sgt. R. W. CROSS, R.A.F.V.R., No. 136 Sqn.
Sgt. J. C. MCCARTNEY, No. 224 Sqn.
Flt. Sgt. R. A. ADAMS, R.A.F.V.R., No. 83 Sqn.
Flt. Sgt. A. H. P. BAINES, R.A.F.V.R., No. 626 Sqn.
Flt. Sgt. W. L. BELL, R.A.F.V.R., No. 57 Sqn.
Flt. Sgt. H. E. BORROW, R.A.F.V.R., No. 83 Sqn.
Flt. Sgt. H. BROWN, R.A.F.V.R., No. 50 Sqn.
Flt. Sgt. W. T. BROWN, R.A.F.V.R., No. 207 Sqn.
Flt. Sgt. S. CARLYLE, R.A.F.V.R., No. 97 Sqn.
Flt. Sgt. H. J. CLARK, R.A.A.F., No. 78 Sqn.
Flt. Sgt. D. COLLINS, R.A.F.V.R., No. 149 Sqn.
Flt. Sgt. (now W/O.) E. A. CRAIGHEAD, R.A.F.V.R., No. 220 Sqn.
Flt. Sgt. J. P. DOW, R.A.F.V.R., No. 97 Sqn.
Flt. Sgt. S. W. EMMS, R.A.F.V.R., No. 158 Sqn.
Flt. Sgt. M. GLEED, R.A.F.V.R., No. 139 Sqn.
Flt. Sgt. G. J. HARPER, R.A.F.V.R., No. 10 Sqn.
Flt. Sgt. R. C. HYDE, R.C.A.F., No. 78 Sqn.
Flt. Sgt. W. J. JAMIESON, R.A.F.V.R., No. 207 Sqn.
Flt. Sgt. G. C. JOHNSON, R.A.F.V.R., No. 156 Sqn.
Flt. Sgt. F. LANGLEY, R.A.F.V.R., No. 201 Sqn.
Flt. Sgt. J. G. L. MARTIN, R.A.F., No. 630 Sqn.
Flt. Sgt. T. C. OVEREND, R.A.F.V.R., No. 9 Sqn.
Flt. Sgt. A. S. PALMER, R.A.F., No. 97 Sqn.
Flt. Sgt. (now P/O.) R. C. PIKE, R.A.F.V.R., No. 97 Sqn.
Flt. Sgt. R. V. POOLEY, R.A.F.V.R., No. 50 Sqn.
Flt. Sgt. L. A. POWELL, R.A.F.V.R., No. 48 Sqn.
Flt. Sgt. S. J. PROCTOR, R.A.F.V.R., No. 50 Sqn.
Flt. Sgt. W. N. ROBERTS, R.A.F.V.R., No. 97 Sqn.
Flt. Sgt. C. SAUNDERS, R.A.F.V.R., No. 149 Sqn.
Flt. Sgt. J. A. THOMAS, R.A.F.V.R., No. 57 Sqn.
Flt. Sgt. R. S. WEBSTER, R.A.A.F., No. 460 (R.A.A.F.) Sqn.
Flt. Sgt. W. R. TUCKER, R.A.F.V.R., No. 44 Sqn.
Flt. Sgt. G. H. WOOD, R.A.F.V.R., No. 626 Sqn.
Flt. Sgt. (now W/O.) E. L. WRIGHT, R.A.F.V.R., No. 97 Sqn.



DOMINION AID : An Avro Lancaster and a Mosquito at the De Havilland Airport in Canada. Both types are under construction in the Dominion.

Sgt. D. R. ALEXANDER, R.A.F.V.R., No. 10 Sqn.
Sgt. E. C. BENHAM, R.A.F.V.R., No. 576 Sqn.
Sgt. C. H. BROWN, R.A.F., No. 50 Sqn.
Sgt. H. J. COUPLAND, R.A.F.V.R., No. 158 Sqn.
Sgt. W. DICKIE, R.A.F.V.R., No. 10 Sqn.
Sgt. W. C. J. KENNY, R.A.F.V.R., No. 10 Sqn.
Sgt. G. R. KETCHER, R.A.F.V.R., No. 426 (R.C.A.F.) Sqn.
Sgt. D. J. D. KING, R.A.F.V.R., No. 149 Sqn.
Sgt. W. H. LYSSINGTON, R.A.F.V.R., No. 625 Sqn.
Sgt. G. H. SIMS, R.A.F.V.R., No. 10 Sqn.
Sgt. J. SOUTHWORTH, R.A.F.V.R., No. 78 Sqn.
Flt. Sgt. T. N. H. FOGATY, R.A.F.V.R., No. 115 Sqn.
Flt. Sgt. P. K. GERICKE, No. 15 Sqn.
Flt. Sgt. R. P. HAYLES, R.A.F.V.R., No. 15 Sqn.
Sgt. R. L. URWIN, R.A.F.V.R., No. 622 Sqn.
Flt. Sgt. R. B. IRWIN, R.C.A.F., No. 78 Sqn.

Roll of Honour

Casualty Communiqué No. 353.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Of the names in this list, 112 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—F/O. R. F. Brodie; Sgt. P. J. Charman; Sgt. K. E. Walmsley.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. E. S. Hayes; Sgt. A. K. B. Kerrigan; Sgt. J. G. Lumley; W/O. D. H. Orchard; Sgt. A. S. Penney.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. R. H. Ancell; Sgt. W. G. Arthur; Sgt. F. J. R. Bain; Sgt. D. R. Barber; Sgt. D. S. Barrett; Sgt. J. A. Bates; Sgt. A. W. Berry; Sgt. K. I. Bowerman; Sgt. C. H. G. Boxall; P/O. D. H. Brook; Sgt. C. V. Brown; Sgt. C. J. Buckel; P/O. R. L. Bulley; F/O. R. D. Caldecourt; Sgt. L. S. Capp; Sgt. H. D. G. Carty; Sgt. I. Caulton; Sgt. H. Clegg; Sgt. J. Clegg; F/O. A. N. Cooper; F/O. A. V. Crawford; F/O. S. A. C. Cutler; Sgt. A. E. Davey; Sgt. W. G. T. Day; F/O. R. L. Donovan; Sgt. S. J. Duckenfield; Sgt. N. Ellis; Sgt. G. R. Evans; Sgt. L. R. Everton; Sgt. S. Fellows; Sgt. G. C. Felsenstein; Sgt. R. W. Floyd; Sgt. L. A. France; P/O. H. M. Gattiker; Sgt. M. A. Gibson; Sgt. K. A. L. Giles; Sgt. W. D. Griffith; Sgt. F. G. Harris; Sgt. L. F. J. Harris; Sgt. K. Henson; Sgt. W. Holding; Sgt. G. Hopkin; F/O. G. Humes; Sgt. A. C. Keightley; Flt. Sgt. D. H. R. Kelly; Wing Cdr. R. H. S. King; P/O. R. N. Kinglake; Flt. Lt. L. H. Knight; P/O. H. J. Koller; Sgt. T. E. W. Latter; Sgt. G. Levins; P/O. T. G. H. Lewis; Flt. Sgt. A. L. Lush; Sgt. J. B. McHendry; Sgt. H. Naiman; Sgt. H. M. Parsons; Sgt. C. Payne; Sgt. G. C. Peters; Sgt. C. E. C. Ransom; Sgt. W. G. Reed; Sgt. W. L. Reed; Sgt. A. Ridge; Sgt. A. E. Roberts; Flt. Sgt. J. L. Sayer; Sgt. R. E. Scott; Sgt. C. F. Simons; Sgt. R. B. Simpson; Sgt. F. N. Slingsby; Sgt. L. E. Smedley; Sgt. D. MacK. Smellie; Flt. Sgt. J. W. T. M. Smith, D.F.M.; Group Capt. W. V. L. Spendlove, D.S.O.; Sgt. F. J. M. Steer; F/O. F. H. Street; Flt. Sgt. G. L. Thomas; Sgt. L. Toal; P/O. A. W. A. Trevarthen; Sgt. J. Turner; Sgt. G. P. Tyrer; Sgt. W. F. Whiteland; Sgt. W. A. Wills; Sgt. W. A. Wyse.

WOUNDED OR INJURED IN ACTION. Sgt. L. Anderson.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Lt. E. A. Carter; Sgt. J. P. Gray; F/O. R. L. Hughes; Sgt. S. W. Irons; Sgt. H. Johnson; Sgt. C. Milburn; Sgt. H. S. Mitchell; Sgt. J. E. F. Paton; Sgt. F. E. A. Rivett.

MISSING.—F/O. F. McI. Allen; Sgt. S. Allom; Sgt. K. Aspinall; Sgt. K. A. Beech; Sqn. Ldr. H. F. Bickerdike, D.F.C.; Sgt. A. R. Bird; P/O. T. F. Bolter; Sgt. H. Bowles; Sgt. W. R. Buntain; Sgt. C. Burgess; Sgt. E. N. Burton; Sgt. H. B. Bushell; Sgt. P. O. Camm; Sgt. W. H. Carter; Sgt. H. A. Clark; Sgt. W. A. Cockburn; Sgt. R. Conrad; Flt. Lt. R. Cook; Sgt. A. P. Coombe; Sgt. D. D. R. Dallsway; Flt. Sgt. R. N. V. Daniel; Sgt. J. H. Dyer; Sgt. E. Edge; Flt. Sgt. W. Ferris; F/O. R. S. Gall; P/O. F. H. Garnett; Sgt. G. Griffiths; F/O. B. Gunnill; Sgt. R. L. Hands; Flt. Sgt. H. Hanson; Sgt. R. T. H. Headford; Flt. Sgt. R. E. Hedges; Sgt. J. Hill; F/O. G. L. Hills, D.F.M.; P/O. E. C. Holbourn; Sgt. A. E. Hooper; Sgt. K. Hunt; Sgt. J. Hurst; Sgt. C. R. King; Sgt. W. R. Knight; Flt. Sgt. L. E. Lambert; P/O. R. H. H. Lunniss; Flt. Sgt. H. M. Lynes; Sgt. D. McCreadie; Sgt. D. McLean; Sgt. T. H. Mallett; Sgt. F. J. Manely; F/O. B. J. Marks; Flt. Sgt. J. R. G. Matthews; Flt. Sgt. S. R. Mattick, D.F.M.; Flt. Sgt. F. H. Morgan; Sgt. H. Morris; Sgt. J. S. Ogg; Act. Flt. Lt. C. J. E. Palmer; Flt. Sgt. W. A. Pavey; Sgt. E. M. J. Pease; P/O. R. W. Pendergrest; Sgt. G. E. Phillips; Sgt. P. E. Pont; Sgt. T. T. Powell; Sgt. D. F. Prusher; Sgt. T. E. Rees; F/O. J. H. Richards; Sgt. E. J. Roberts; F/O. J. Scales; Sgt. R. D. Seddon; Flt. Lt. F. G. Shaw; Sgt. J. Smethurst; P/O. R. Stobo; Sgt. F. E. Summers; Flt. Lt. W. J. Taylor; Flt. Sgt. T. J. Thomas; Sgt. T. G. Townson; Sgt. A. A. Tucker; Sgt. F. J. Tunnicliff; Sgt. C. R. Underhill; Sgt. H. V. Walmsley; Sgt. R. F. Walter; F/O. N. J. Warfield, D.F.M.; Sgt. D. Wetherell; Flt. Sgt. W. T. Whitmore; Sgt. K. Wightman; Sgt. J. A. Wilde; Sgt. W. P. Wilson; Sgt. J. A. Withington; Sgt. R. A. Yale; F/O. G. T. Young.

KILLED ON ACTIVE SERVICE.—Sgt. N. I. Bates; F/O. H. S. Botell; F/O. W. Bradley; L.A/C. H. J. Brailsford; Sqn. Ldr. W. D. B. S. Davie; F/O. E. P. I. Fallowes; Sgt. E. A. Farthing; Sgt. E. R. Francis; A/C.1 L. F. Gough; Flt. Sgt. G. Higgs; F/O. K. Holland; P/O. W. A. Hughes; L.A/C. D. W. Johnston; Sgt. C. J. Jones; Flt. Sgt. J. M. Jones; Act. Wing Cdr. E. C. Le Mesurier, D.S.O., D.F.C.; F/O. J. E. Lindsay; Sgt. C. H. Lord; F/O. C. T. Reid; Act. Flt. Lt. W. J. Westwood.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. H. Alford; Cpl. E. J. Botfield, Sgt. E. Vevers.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Flt. Sgt. K. Davey; Flt. Sgt. T. K. Matthews; A/C.2 F. N. Rix; F/O. F. E. Whitehouse.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—A/C.2 N. B. Bell.

DIED ON ACTIVE SERVICE.—L.A/C. E. P. Baldwin; A/C.1 A. H. Belfield; A/C.2 A. F. Betteridge; Cpl. B. C. Bowerman; A/C.1 W. H. Burnett; Cpl. T. J. Cornelius; Flt. Sgt. A. E. Gillinder; A/C.2 W. T. Goodwin; L.A/C. H. Greenwood; Cpl. F. W. Harris; Cpl. A. E. Hewitt; A/C.2 E. Heeley; A/C.1 J. Hoggard; A/C.1 G. W. Horton; Sgt. E. Hudson; Cpl. A. T. Jones; Cpl. S. C. Joyce; L.A/C. J. McCallum; A/C.2 S. Maler; L.A/C. S. Parry; A/C.1 O. C. Reddin; L.A/C. E. G. Rogers; A/C.1 S. H. Rogers; Sgt. H. A. Sheppard; Act. Flt. Lt. H. J. Stephenson; L.A/C. R. Thomas; L.A/C. F. W. Turner; Cpl. H. C. Wilkes; A/C.1 J. J. Williams; L.A/C. G. T. Wood; Flt. Sgt. L. G. Young-Hart.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. J. G. S. Walker.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—A/CW.2 M. Hemingway; A/CW.2 J. M. Newmarch; A/CW.1 E. J. Wilkins.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. D. R. Grant; Sgt. S. J. Marriage; Sgt. L. H. Schultz.

MISSING.—Flt. Sgt. J. Butterworth; Flt. Sgt. K. R. R. Glover; P/O. A. W. Heap; Flt. Sgt. A. M. Legrand; F/O. C. P. Luther; Flt. Sgt. R. B. McMillan; Flt. Sgt. R. D. McWha; Flt. Sgt. W. D. B. O'Dea; Flt. Sgt. C. L. Robinson; F/O. F. W. Rush; Flt. Sgt. L. M. Ryan; F/O. W. V. Scott; P/O. R. R. Stain; P/O. B. A. Tait; P/O. G. Tyler; Flt. Sgt. W. M. Waterman; W/O. W. A. Watson.

KILLED ON ACTIVE SERVICE.—F/O. F. C. Boyce; Flt. Sgt. D. J. M. Brown; Flt. Sgt. B. K. F. Carter; Flt. Sgt. J. E. Findley; Flt. Sgt. E. Hoskings; Sgt. E. J. Strawbridge; Flt. Sgt. N. R. B. Toy; Flt. Sgt. G. M. Vautier.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. D. L. S. Martin.

Royal Canadian Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. E. A. Allen; F/O. F. N. S. Cavanaugh; Sgt. G. C. Gale; Sgt. R. G. Griffin; W/O. G. R. Holm; Sgt. J. N. C. Hornidge; Flt. Sgt. L. J. Lalonde; Flt. Sgt. J. H. Lemon; Flt. Sgt. R. J. T. Lynn; P/O. D. O. McMahon; Sgt. C. MacK. Moffatt; Sgt. W. J. Reid; F/O. L. J. Stewart.

MISSING.—Flt. Sgt. J. A. Leboldus; Flt. Sgt. F. A. Spencer.

KILLED ON ACTIVE SERVICE.—P/O. G. O. Dawson; F/O. D. H. Owens; W/O. S. R. Shaw.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. J. B. Reid.

DIED ON ACTIVE SERVICE.—P/O. E. J. Conway.

Royal New Zealand Air Force

KILLED IN ACTION.—Flt. Sgt. R. A. Southward.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. L. E. Workman.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Act. Flt. Lt. E. McL. Gray, D.F.C.; F/O. D. I. McNarey; Flt. Sgt. D. G. Ridings.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Lt. D. W. Metherell.

MISSING.—Flt. Sgt. M. L. Bartley; Flt. Sgt. A. H. Hayward; F/O. R. A. Peters; Act. Flt. Lt. J. C. Ralph, D.F.M.

South African Air Force

MISSING.—2/Lt. D. J. Campbell; Lt. D. J. Cowie.

KILLED ON ACTIVE SERVICE.—Lt. S. A. Hartley; Lt. M. J. Jackson; 2/Lt. R. Y. Lewis; Act. Flt. Sgt. D. G. Osler; Act. Flt. Sgt. F. E. Wolmarans

Casualty Communiqué No. 354

Of the names in this list 105 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Sgt. A. Braid; Sgt. M. G. Capel; Sgt. G. Hankins; F/O. R. H. Mawle; Sgt. P. P. O'Meara; Sgt. J. R. Rounding; Sgt. E. Skelton.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. J. E. O'N. Cassell; Sgt. J. Gallo-

SOLDIER AIRMEN: R.A.F. aircrews now go through a special course of ground fighting to enable them to defend their own airfields if necessary. They are shown here crossing a stream under fire.

way; Sgt. E. Jeffs; Sgt. W. J. Randall; Sgt. G. J. D. Thompson; P/O. G. R. Wright.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. K. Ambler; Flt. Lt. R. H. Ashton; Sgt. K. T. Bates; P/O. E. S. Bawden; Sqn. Ldr. F. C. Bertram; Sgt. R. H. Boone; Sgt. W. C. Bostock; Sgt. J. T. Bostock; Sgt. J. P. H. Brownlee; Sgt. E. G. Buscombe; Sgt. E. Cassingham; Flt. Sgt. D. I. Clunes; Sgt. P. H. Eldridge; Sgt. G. Errington; Sgt. C. Greenhalgh; Flt. Sgt. F. J. Greenwood; Sgt. C. H. Herbert; P/O. G. R. Herbert, D.F.M.; Sgt. R. Heslop; Act. Flt. Lt. R. Y. Higginson, D.F.M.; Sgt. T. L. V. Hitchcock; Sgt. J. R. Hunter; Sgt. J. C. Jones; Sgt. A. L. Larner; Sgt. P. Lees; Sgt. R. B. McPherson; Sgt. C. Maurice; P/O. J. E. Morris; Sgt. T. Musgrove; Sgt. T. E. Musto; Sgt. J. D. Olding; Sgt. F. T. Peake; Sgt. L. A. Rumery; Flt. Sgt. F. Stewart; Sgt. D. A. Travis; Sgt. C. W. Warne; Flt. Sgt. J. Warnes; Sgt. S. G. Webb; Sgt. E. D. G. White.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Flt. Lt. W. W. Swinnerton.

WOUNDED OR INJURED IN ACTION.—Act. Sqn. Ldr. M. G. Birt; F/O. E. A. Worthy.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. A. Bostock.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. D. O. Davies; Sgt. K. J. Dunger; Act. Flt. Sgt. R. Fiddes; Sgt. R. B. Hoynes; Sgt. H. R. Kitchener; Sgt. D. Williams.

MISSING.—F/O. J. Anstee; Sgt. A. S. Baker; Sgt. K. C. Bartlett; Flt. Sgt. K. F. F. Barton; Sgt. G. F. K. Bedwell; Sgt. J. Biggs; Sgt. W. H. Blake; F/O. A. Bradshaw; Sgt. J. W. Brewster; F/O. N. H. Cain; Sgt. J. Calvert; Sgt. G. Chapman; Sgt. W. J. Churcher; Sgt. G. F. Clark; Sgt. J. L. Colbourne; P/O. W. J. Craddock; Sgt. G. E. Crawford; Sgt. J. R. Davidson; Sgt. A. S. Davis; Sgt. E. A. Dickhart; Flt. Sgt. N. F. Dixon; Sgt. S. V. Domleo; P/O. K. A. R. Douglas; F/O. J. A. Dutton; Act. Flt. Lt. G. H. Ebert, D.F.C.; Flt. Sgt. S. Evans; P/O. G. F. W. Few; Sgt. A. R. Fleming; Sgt. W. Fox; Sgt. H. Gordon; Sgt. L. Gorman; Sgt. B. O. Greenhill; Sgt. J. Greenwell; F/O. C. N. Hale; Sgt. P. G. Hancock; Flt. Sgt. W. Hardaker; Flt. Sgt. C. R. Harrison; F/O. A. Hazell; Sgt. R. J. Heal; F/O. D. W. Herbert; F/O. P. N. Hodgson; Sgt. W. Hope; F/O. C. Hughes; Sgt. B. G. Imber; Wing Cdr. A. D. Jackson; Flt. Sgt. G. L. James; Sgt. R. W. Jeffs; Flt. Sgt. W. Jenkins; Sgt. E. D. Keene; Sgt. J. E. Kennison; Sgt. P. G. L. Kerr; Sgt. C. H. Kewley; Sgt. D. J. Leslie; Flt. Lt. D. G. McAlpine; W/O. J. McGinlay; Sgt. A. G. Matthes; Sgt. A. S. Matthews; Sgt. A. H. Miller; Sgt. L. G. Miller; F/O. H. Mordue; Flt. Sgt. J. K. Morton; Sgt. G. B. Mowbray; Flt. Sgt. H. S. Murton; Sgt. A. E. Naylor; Flt. Sgt. E. C. Nicholls; Sgt. T. L. North; Sgt. P. R. Pae; Sgt. R. Parkinson; Sgt. H. Patrick; P/O. K. D. Pearce; P/O. D. L. Pirie; Sgt. D. J. Poole; Sgt. R. J. Poulter; Sgt. J. Redhead; Flt. Sgt. G. L. Renshaw; Sgt. R. W. Roberts; Sgt. A. Ross; Flt. Lt. A. W. Ruffhead; Sgt. J. Russell; Sgt. C. Seddon; F/O. A. V. Shirley; Flt. Sgt. F. T. M. Sidebotham; Flt. Sgt. A. J. Simmons; Sgt. R. F. Smale; Act. Flt. Sgt. D. J. J. Smith; Sgt. J. Southwell; Sgt. W. A. H. Squire; F/O. A. F. P. Stanislaus; Sgt. R. B. Stocks; Sgt. F. A. Sugden; Sgt. J. Sutton; Sgt. T. Thompson; Act. Sqn. Ldr. P. G. Thornton-Brown; Flt. Sgt. J. T. Toplis; Flt. Sgt. J. M. Turnbull; Sgt. W. R. Tyrie, D.F.M.; Act. Flt. Sgt. G. Vandervyver; Sgt. Ldr. K. F. Vare; Sgt. D. W. Walker; Sgt. W. J. Walsh; F/O. G. Ward; Sgt. G. L. Waters; Sgt. R. E. Watts; Sgt. B. S. J. West; F/O. N. E. Westergaard; Sgt. R. C. Whale; Sgt. W. E. Whitmarsh; Flt. Sgt. C. J. G. Wilce; F/O. E. A. C. Willard; Sgt. W. M. Wilson; Sgt. F. J. Wright.

KILLED ON ACTIVE SERVICE.—F/O. C. R. Amos; Sgt. T. Briggs; W/O. G. Crombie, D.F.M.; Sgt. E. A. Dean; L.A/C. N. W. Fisher; Flt. Lt. J. P. Franklin; Sgt. T. J. Freeman; F/O. D. G. Greville; Sgt. T. G. Higgins; Sgt. J. M. Holmes; L.A/C. A. V. Hood; Sgt. T. B. Joyce; Flt. Sgt. MacD. A. Keith; P/O. J. W. Lorrimore; F/O. D. E. Lumsden; F/O. H. E. Massey; Sgt. H. W. Miller; F/O. R. J. A. Mills; Sgt. T. F. H. Mills; Sgt. G. C. O'Neill; Flt. Sgt. G. C. Peaker; Sgt. H. W. Salmon; Sgt. G. J. K. Shears; F/O. P. R. Street, D.F.M.; F/O. V. Tanner; W/O. A. S. Twomey; Flt. Sgt. J. H. Waters; Sgt. J. Whitehead; L.A/C. S. M. Wright.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. P. A. North.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Flt. Sgt. R. D. Garware.

DIED ON ACTIVE SERVICE.—W/O. A. E. Barlow; L.A/C. A. F. Billenness; A/C.2 G. M. Bowen; P/O. A. E. Chance; L.A/C. D. H. Martin; A/C.1 G. Raper; L.A/C. K. H. Stout.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. C. Hunt; Sgt. D. R. Spencer; Sgt. J. E. Ward.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. B. W. Westerberg.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. J. W. Campbell; Flt. Sgt. W. J. Larcombe; Flt. Sgt. M. F. Lay.

MISSING, BELIEVED KILLED IN ACTION.—F/O. J. P. Raffen.

MISSING.—P/O. A. E. Blight; P/O. J. R. Henningham; P/O. S. J. Ireland; P/O. R. A. P. McKillop; Flt. Sgt. M. McMahon; Flt. Sgt. W. J. Roche; Flt. Sgt. M. H. Squires; Flt. Sgt. J. P. Yabsley.

KILLED ON ACTIVE SERVICE.—F/O. F. L. Ingham; Flt. Sgt. C. E. Ryall.

Royal Canadian Air Force

KILLED IN ACTION.—F/O. F. H. Dennison; Flt. Sgt. C. W. Taylor.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. P. J. A. Dennis; F/O. R. J. L. Fowler; Flt. Sgt. J. D. Hamilton; F/O. C. D. Hosken; Flt. Sgt. M. P. Kimber; W/O. R. M. Lawrence; W/O. J. J. Reansbury.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. A. F. Birkbeck; Sgt. W. Bodley; F/O. F. S. Buck; Sgt. L. R. Coutts; Sgt. W. J. Dawson; Sgt. P. J. Duffy; Sgt. R. C. Ferguson; Sgt. H. W. Fill; Sgt. J. H. Fitch; Sgt. O. K. Glascock; Sgt. J. G. Grainger; Sgt. E. W. Haglund; P/O. B. M. Harker; Sgt. W. C. Hencke; F/O. P. G. Holt; Sgt. A. M. Kelly; Sgt. T. A. McDowell; F/O. T. R. Mellish; Sgt. R. Mucklow; P/O. C. D. Myers; Sgt. E. L. Newburg; Sgt. S. T. O'Connor; Sgt. R. F. C. Porter; Flt. Sgt. W. R. Prentice; Sgt. C. F. Rimmer; Sgt. A. R. Ross; F/O. J. R. Sergeant; F/O. M. Shvemar; Sgt. J. A. Smith; Sgt. J. W. Stephen; Flt. Sgt. G. L. Tyrone.

WOUNDED OR INJURED IN ACTION.—Flt. Sgt J. C. Dickinson.

MISSING.—F/O. A. P. Campbell; Flt. Sgt. B. C. Cameron; Flt. Sgt. W. L. J. Clark; F/O. T. H.

SERVICE AVIATION

Donnelly, D.F.M.; Flt. Sgt. W. L. Doran; P/O. J. B. Dunne; P/O. T. D. Gavin; F/O. D. A. MacDonald; F/O. A. J. Salaba; F/O. G. E. Sharpe; P/O. D. Thompson; Sgt. R. Zimmer.

KILLED ON ACTIVE SERVICE.—F/O. A. N. Book; Sgt. J. E. R. Cote; Flt. Sgt. G. T. Gerow; Flt. Sgt. F. C. Mison; Sgt. D. S. Robertson.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—P/O. R. H. Bedell.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Flt. Sgt. J. D. MacNeill.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. J. O. B Mooney; F/O. E. L. Sadler.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. N. Breward; Flt. Sgt. E. H. Behrent.

MISSING.—F/O A. G. MacDonald.

South African Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Lt. D. M. Chaplin; Lt. D. R. Davies; Flt. Sgt. K. A. Duncan; Lt. R. M. Hilligan; Lt. G. Lloyd, D.F.C.; Lt. R. L. McCartney; Flt. Sgt. L. Orlek; Lt. G. E. Sale; Lt. A. F. Tyrrell; Lt. L. F. Walthers.

MISSING.—Capt S. Brown; Lt. Gilludeau; Lt. G. T. Bold.

Indian Air Force

KILLED ON ACTIVE SERVICE.—L.A/C. Venuthpal.

Casualty Communiqué No 355

Of the names in this list, 106 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Flt. Sgt. W. Cross; F/O. E. B. Fooks; Flt. Sgt. C. H. Forsyth; Flt. Sgt. D. Morris; Flt. Sgt. S. C. Norton; Flt. Sgt. G. T. Ormandy; Flt. Sgt. T. Riordau; P/O. L. A. Taylor.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. I. B. Brown; Flt. Sgt. D. W. C. Fletcher; Sgt. G. C. Garner; Sgt. E. Lidster; Sgt. P. V. Tanner.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. G. A. Axup; Sgt. R. J. Barkham; Sgt. W. Billington; Act. Wing Cdr. H. P. Blatchford, D.F.C.; Sgt. W. J. Blundell; Sgt. R. Brown; Sgt. N. R. Burrows; P/O. E. F. Campbell; P/O. C. Coleman; Sgt. G. Cooper; Sgt. S. W. Cowham; Flt. Sgt. R. J. Crossley; Sgt L. F. C. Day; Sgt. F. J. Earle; F/O. J. L. Edwards; Sgt. K. F. Erne; Sgt. N. L. Fauvel; Sgt. A. A. Fitzpatrick; Sgt. J. Forrest; Sgt. E. W. Foster; P/O. M. J. D. Fuller; F/O. L. G. Gill; P/O. H. B. Gonce; Sgt. A. Graham; P/O. A. V. Harper; P/O. W. R. Hendon; Sgt. H. P. Holme; Sgt. J. Holmes; Flt. Sgt. K. D. Jones; Flt. Sgt. J. S. Keay; Sgt. J. N. Kelsall; P/O. K. R. Langhorne; Sgt G. P. Lister; P/O. H. R. S. Lloyd; Sgt. S. C. Luke; Sgt. D. McColl; Sgt. J. Marriott; Sgt. S. S. Marshall; P/O. R. Massie; Sqn. Ldr. H. E. Maudslay, D.F.C.; Flt. Sgt. A. J. Mills; Sgt. V. C. G. Moody; Sgt. G. Phillips; Flt. Sgt. F. Poore; Sgt. E. A. Pye; Sgt. J. J Reade; Sgt. H. Robinson; Sgt. G. Rose; P/O. A. R. Schofield; Act. Flt. Lt. R. J. Shufflebotham; Sgt. R. Y. Stoddart; P/O. H. J. Summers; Sgt. D. A. Thomas; Sgt. D. B. Tibble; P/O. J. M. Traynor; Sgt. L. Tucker; P/O. W. J. Tytherleigh; Sgt. R. O. Vaughan; Sgt. K. A. Way; Sgt. J. Wood; Sgt. G. C. Wright; F/O. C. W. E. Young; Sgt. W. Young.

WOUNDED OR INJURED IN ACTION.—Flt. Sgt. F. V. Thomas; Sgt. H. Todd.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. W. J. Bellinger; F/O. J. Blair; Sgt. N. W. E. Blatch; Sgt. D. F. Butler; Flt. Sgt. W. D. V. Cable; F/O. H Clark; Sgt. T. R. Derrington; Sgt. D F. Faulkener; Flt. Sgt. J. W. Hinde; Sgt. S. P. Mirams; Sgt. K. Perkins; Sgt. D. L. Purvis; Sgt. K. W. Smith; W/O. P. R. Waller; Sgt. A. W. Watson.

MISSING.—F/O. D. N. Armitage; Flt. Sgt. T. H. Badkin; Sgt. L. Banks; Sgt. R. R. Barbour; Flt. Sgt. G. Barry; F/O. L. H. Bear; Flt. Sgt. J. Bell; Sgt. R. Betts; Sgt. E. Birchill; Sgt. E. J. Blackley; P/O. C. E. Blanchette; F/O. R. Bolsover; P/O. G. P. B. Bond; Flt. Sgt. G. M. Boon; P/O. W. J. Bottrell; P/O. R. J. Bowen; Sgt. E. R. W. Brown; Sgt. R. Chambers; Sgt. R. Clark; Sgt. J. E. Clarke; Sgt. K. T. Cooper; Sgt. D. Corbitt; Sgt. L. C. Cornwell; Flt. Lt. R. P Cuninghaam; Flt. Sgt. S. D. Cunningham; Sgt. W. R. Day; F/O. H. A. Derries; Sgt. R. F. Dearden; F/O. T. Docherty; Sgt. S. Ecclestone; Sgt. J. E. Fake; Act. Sqn. Ldr. R. E. Fawcett, D.F.C.; F/O. P H. Froment; P/O. L. F. Gill; Sgt. A. F. Gleadle; Flt. Sgt. J. Gray; Flt. Sgt. W. M. Green; P/O. C. M. Handley; Sgt. D. B. Harvey; P/O. P. E. Head; Flt. Sgt. G. M. Headley; Flt. Sgt. P. H. O. Herbert; Sgt. H. W. Hewitt; Sgt. F. Holland; Sgt. E. Holloway; Sgt. A. Holmes; Act. Flt. Lt. C. F. Horner; Flt. Sgt. R. J. Hudson; Sgt. R. Hughes; Sgt. J. Ireland; Sgt. R. E. Jordan; P/O. T. H. Knight; Sgt. H. R. Lintern; Sgt. G. A. Litchfield; Flt. Sgt. W. Lumsden, D.F.M.; Sgt. E. Lunniss; P/O P. R. Lyford; Sgt. M. Maher; F/O. R. J. A. Maidstone; Sgt. A. E. Marsland; Flt. Sgt. D. A. Mills; Flt. Sgt. B. C. Hinks; Sqn. Ldr. W. S. Moore; P/O. A. Morassi; Flt. Sgt. J. Murray; Sgt. J. H. Newton; Sgt. J. C. O'Mahony; Sgt. F. W. Portecus; Flt. Sgt. T. W. Pragnell; P/O. G. Ratcliffe; Sgt. W. T. Rees; Sgt. J. J. Robertson; F/O. J. Storey; Sgt. H. Street; Act. Sqn. Ldr. R. G. F. Stewart, D.F.C.; Sgt. R. Stripe; Sgt. D. J. Symonds; Flt. Sgt. F. Thorington; Sgt. G. B. Tutt; Flt. Sgt. R. Underwood, D.F.M.; P/O. G. Vickers; Sgt. K. H. H. Wardle; F/O. V. Waterhouse; Sgt. W Welby; Sgt. F. R. Westall; Sgt. S. W. Whitney; Sgt. M. S. Williams; Sgt. L. D. Wilson; Flt. Sgt. R. A. C. Wilson; Sgt. A. R. C. Yeatman.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. G. Heseltine; Sgt. D. H. Pinney.

KILLED ON ACTIVE SERVICE.—Sgt. G. Heseltine; Sgt. D. H. Pinney.

KILLED ON ACTIVE SERVICE.—P/O. J. P. Angold; P/O. F. R. Bullock; Flt. Sgt. D. W. Earney; Flt. Sgt. J. R. Faulkner; P/O. J. A. Gordon; Flt. Lt. R. Hartley; Sgt. L. J. J. Henley; F/O. P. J. Hugo; Flt. Lt. K. F. Jolly; F/O. T. W. Kempin; Sgt. J. E. Lane; Sgt. H. J. Noy; Flt. Lt. H. S. Ray; F/O. M. L. H. Rose; Sgt. D. E. Russell; Sgt. A. A. Sadler; L.A/C. W. O. Slassor; Sgt. R. J. Tilbury.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. W. D. Keen.

WOUNDED OR INJURED ON ACTIVE SERVICE.—A/C.1 H. Brabon; F/O. L. T. Mersham.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Flt. Sgt. C. G. C. Fletcher.

DIED ON ACTIVE SERVICE.—A/C.1 S. H. Bartrum; A/C.1 A. B. Campbell; L.A/C. J. Collins; L.A/C. D. C. Cove; A/C.1 C. Fairclough; W/O. W. A. Fairhurst; A/C.2 R. A. D. Hole; L.A/C. R. McFarlane; Cpl. S. D. L. Peterson; L.A/C. C. J. Rowbotham; F/O. R. B. R. Shetliffe; Cpl. W. G. V. Simpson; Act. Flt. Lt. F. J. G. Thornton; Cpl. T. Tierney; L.A/C G. West; Cpl. R. Williams.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. F. J. H. Heathfield; Sgt. J. J. Sparrow.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—Cpl. M. D. Philip; A/CW.2 D. I. B. Slade.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. J. K. Somers.

ECONOMICAL AVIATION: Thousands of A.T.C. cadets have passed their glider test during the past year. Many of the units are building their own gliders for use during the coming summer.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sg. A. Gordon; Flt. Sgt. D. C. P. Lundie; Flt. Sgt. P. M. MacKenzie; Flt. Sgt. A. W. Teerman.

MISSING.—Flt. Sgt. W. D. Blackwell; Flt. Sgt. A. H. Boettcher; Flt. Sgt. W. C. Butler; P/O. C. L. Gunther; Act. Flt. Lt. M. S. Fletcher; Flt. Sgt. A. C. Hall; Flt. Sgt. B. J. V. King; Flt. Sgt. C. E. McEvoy; Flt. Sgt. J. Mudie; Flt. Sgt. L. K. Nicholl; W/O. R. B. O'Neill; Flt. Sgt. B. A. C. Paterson; Act. Flt. Lt. L. B. Patkin; F/O. W. Raper; F/O. W. A. Robertson; W/O. R. K. Saunders; Flt. Sgt. H. D. Scott; Sgt. A. D. Smith; Flt. Sgt. R. C. Tyas; Flt. Sgt. C. Wilson.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. C. G. Eckersley; Flt. Sgt. D. R. Hill; Sgt. A. Migner; Sgt. H. Peters; Sgt. H. St. G. Thompson; Flt. Sgt. G. R. Tippett.

Royal Canadian Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. F. J. MacK. Ashdown; Sgt. L. J. Baribeau; Flt. Sgt. R. J. Barnes; Flt. Sgt. G. H. Bartman; Flt. Sgt. D. B. Coons; Flt. Sgt. L. R. Crowe; Sgt. G. J. Darling; Sgt. B. M. Harvey; Act. Flt. Lt. A. M. Hill; Act. Flt. Lt. W. T Johnstone; Flt. Sgt. L. J. Krulicki; Flt. Sgt. H. C. Lewis; Sgt. J. P. MacCallum; Sgt. C. McKerns; Sgt. R. M. Mayberry; Sgt. J. H. Paquin; Sgt. A. E. Prime; Flt. Sgt. J. M. Rogal; P/O. J. H. Samnet.

MISSING, BELIEVED KILLED IN ACTION.—P/O. L. A. Frost.

MISSING.—Flt. Sgt. C. A. Besse; W/O. J. S. Briegel; F/O. M. Gennis; Flt. Sgt. D. J. Gibson; F/O. T. C. Gierulski; P/O. G. B. Loney; F/O. R. E. MacFarlane, D.F.M.; Act. Flt. Lt. W. J. Maitland, D.F.M.; Flt. Sgt. R. Pettitt; Flt Sgt. J. E. Saunders; F/O. L. E. Thompson; W/O. H. A. Turner.

KILLED ON ACTIVE SERVICE.—P/O. J. W. Butcher; P/O. J. A. McIntosh.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—F/O. L. J. Ashburner.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. B. J. Deering; W/O. J. S. Phelps; Sgt. W. M. Spafford.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. W. T. Ellis; P/O. C. B. Pearce, D.F.M.; P/O. E. L. Robson.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION —Act. Sqn. Ldr. W. A. C. Ball; Sgt. C. S. Burton; Sgt. M. E. J. Shogren.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. K. G. Tucker.

PREVIOUSLY REPORTED MISSING, NOW PREPORTED PRISONER OF WAR.—Flt. Sgt. W. J. Cave.